

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

3SHAPE A/S and 3SHAPE INC.
Petitioners

v.

DENTAL IMAGING TECHNOLOGIES CORPORATION
Patent Owner

Case No. IPR2024-00549
Patent 11,234,798

**DECLARATION OF ELI SABER IN SUPPORT OF
PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 11,234,798**

3SHAPE EXHIBIT 1003
3Shape v. DITC
IPR2024-00549

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

TABLE OF CONTENTS

I.	INTRODUCTION	1
II.	BACKGROUND AND QUALIFICATIONS	2
III.	INFORMATION CONSIDERED	7
IV.	RELEVANT LEGAL STANDARDS	7
A.	Claim Interpretation	7
B.	Perspective of One of Ordinary Skill in the Art.....	8
C.	Anticipation	8
D.	Obviousness.....	9
V.	SUMMARY OF OPINIONS.....	12
VI.	THE CHALLENGED '798 PATENT	13
VII.	LEVEL OF ORDINARY SKILL IN THE ART	13
VIII.	TECHNICAL BACKGROUND	14
A.	The Purported Invention.....	14
B.	Summary of the Applied Prior Art.....	14
1.	Zhang (EX1007)	15
2.	Babayoff (EX1008).....	15
3.	Fisker (EX1009).....	16
4.	Dillon (EX1010)	16
5.	Johnson (EX1011).....	17
IX.	CLAIM CONSTRUCTION	17

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

X.	CLAIMS 1–6, 10–15, AND 17–19 WOULD HAVE BEEN OBVIOUS OVER ZHANG IN VIEW OF BABAYOFF (GROUND 1).	19
A.	Claim 1 (Preamble): A system for generating an intra-oral scan of dentition, the system comprising:	19
1.	[1.1]: a memory; and	21
2.	[1.2]: a processor coupled to the memory, wherein the processor is configured to:	22
3.	[1.3]: generate a contiguous scan of an occlusal surface of at least a part of one arch of dentition, ...	23
4.	[1.4]: remove image data of soft tissue from the contiguous scan of the occlusal surface based at least in part on an analysis of 3D data from the contiguous scan to distinguish between image data of the dentition and the image data of the soft tissue, wherein the soft tissue includes at least one selected from a group consisting of a tongue, a cheek, and a lip, and	24
5.	[1.5]: associate a scan of at least one additional surface to the contiguous scan of the occlusal surface by	27
6.	[1.6]: analyzing the scan data to identify a portion of the scan of the at least one additional surface that overlaps with a portion of the contiguous scan of the occlusal surface, ...	29
7.	[1.7]: wherein the scan of the at least one additional surface includes a sequence of image frames including a plurality of image frames of the occlusal surface interspersed with a plurality of image frames of the at least one additional surface, and	30
8.	[1.8]: determining a position of the scan of the at least one additional surface relative to the scan of the occlusal surface based on the identified overlapping portions, ...	32

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

9. [1.9]: wherein the processor is configured to generate the contiguous scan of the occlusal surface by capturing a plurality of partially overlapping image frames of the occlusal surface and stitching the overlapping image frames together to form a 3D model of the occlusal surface, ...34
10. [1.10]: wherein the processor is configured to remove the image data of the soft tissue from the contiguous scan by removing the image data of the soft tissue from the overlapping image frames used to generate the occlusal scan, and.....37
11. [1.11]: wherein the processor is further configured to update the contiguous scan of the occlusal surface by restitching the overlapping image frames together after removing the image data of the soft tissue to form an updated 3D model of the occlusal surface. 39
- B. Claim 2: The system of claim 1, wherein the processor is further configured to associate a plurality of scans of additional surfaces to the contiguous scan of the occlusal surface, wherein the plurality of scans of the additional surfaces includes a plurality of scans of labial surfaces and a plurality of scans of lingual surfaces.....41
- C. Claim 3: The system of claim 1, ...42
 1. [3.1]: wherein the plurality of image frames of the occlusal surface from the scan of the at least one additional surface each overlap with the contiguous scan of the occlusal surface,.....42
 2. [3.2]: wherein the plurality of image frames of the at least one additional surface includes image frames of a labial or lingual surface, and.....43
 3. [3.3]: wherein the processor is configured to use the plurality of image frames of the occlusal surface that is included in the scan of the at least one additional surface

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

	to determine a position of the image frames of the labial or lingual surface relative to the contiguous scan of the occlusal surface.	44
D.	Claim 4: The system of claim 2, wherein the occlusal surface is imaged prior to the plurality of labial and lingual surfaces, and wherein the processor is further configured to display in real-time a three-dimensional representation of the dentition as te plurality of labial and lingual surfaces are imaged.	45
E.	Claim 5: The system of claim 4, ...	46
1.	[5.1]: wherein the processor is configured to display in real-time the three-dimensional representation of the dentition by performing a coarse matching by matching features as the plurality of labial and lingual surfaces are imaged, and	46
2.	[5.2]: wherein the processor is further configured to generate a three-dimensional reconstruction of the dentition based on a point cloud alignment after the plurality of labial and lingual surfaces are all imaged.	47
F.	Claim 6: The system of claim 1, wherein the processor is further configured to generate an occlusal backbone by matching selected frames of the contiguous scan of the occlusal surface that have an overlap based on an analysis of data.	48
G.	Claim 10 (Preamble): A computer readable storage medium for generating an intra-oral scan of a dentition, wherein code stored in the computer readable storage medium, when executed by a processor, causes a system to:	49
1.	[10.1]: generate a contiguous scan of an occlusal surface of at least a part of one arch of the dentition by capturing a plurality of partially overlapping image frames of the occlusal surface and stitching the overlapping image frames together to form a3D model of the occlusal surface;	51

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

2. [10.2]: remove image data of soft tissue from the overlapping image frames used to generate the occlusal scan based at least in part on an analysis of 3D data from the contiguous scan to distinguish between image data of the dentition and the image data of the soft tissue, wherein the soft tissue includes at least one selected from a group consisting of a tongue, a cheek, and a lip; 51
 3. [10.3]: update the contiguous scan of the occlusal surface by restitching the overlapping image frames together after removing the image data of the soft tissue to form an updated 3D model of the occlusal surface; and 52
 4. [10.4]: associate a scan of at least one additional surface to the contiguous scan of the occlusal surface by analyzing the scan data to identify a portion of the scan of the at least one additional surface that overlaps with a portion of the contiguous scan of the occlusal surface,.....53
 5. [10.5]: wherein the scan data includes a sequence of image frames including a plurality of image frames of the occlusal surface interspersed with a plurality of image frames of the at least one additional surface and 53
 6. [10.6]: determining a position of the scan of the at least one additional surface relative to the scan of the occlusal surface based on the identified overlapping portions. 54
- H. Claim 11: The computer readable storage medium of claim 10, wherein the code, when executed by the processor, further causes the system to associate a plurality of scans of additional surfaces to the contiguous scan of the occlusal surface, wherein the plurality of scans of the additional surfaces includes a plurality of scans of labial surfaces and a plurality of scans of lingual surfaces.....54
- I. Claim 12: The computer readable storage medium of claim 11, wherein the occlusal surface is imaged prior to the plurality of labial and lingual surfaces, and wherein the code, when

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

- executed by the processor, causes the system to display in real-time a three-dimensional representation of the dentition as the plurality of labial and lingual surfaces are imaged. 55
- J. Claim 13: The computer readable storage medium of claim 12, wherein the code, when executed by the processor, causes the system to display in real-time the three-dimensional representation of the dentition by performing a coarse matching by matching features as the plurality of labial and lingual surfaces are imaged, and wherein the code, when executed by the processor, further causes the system to generate a three-dimensional reconstruction of the dentition based on a point cloud alignment after the plurality of labial and lingual surfaces are all imaged. 56
- K. Claim 14: The computer readable storage medium of claim 10,.....57
1. [14.1]: wherein the plurality of image frames of the occlusal surface from the scan of the at least one additional surface each overlap with the contiguous scan of the occlusal surface.....57
2. [14.2]: wherein the plurality of image frames of the at least one additional surface includes image frames of a labial or lingual surface, and.....57
3. [14.3]: wherein the code, when executed by the processor, causes the system to use the plurality of image frames of the occlusal surface that is included in the scan of the at least one additional surface to determine a position of the image frames of the labial or lingual surface relative to the contiguous scan of the occlusal surface. 58
- L. Claim 15: The computer readable storage medium of claim 10, wherein the code, when executed by the processor, further causes the system to generate an occlusal backbone by matching selected frames of the contiguous scan of the occlusal surface that have an overlap based on an analysis of data.....58

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

M.	Claim 17: The computer readable storage medium of claim 15 wherein the occlusal backbone is a first occlusal backbone, and wherein the code, when executed by the processor, further causes the system to generate a second occlusal backbone that is more accurate than the first occlusal backbone by linking other frames that are different from the selected frames to the first occlusal backbone.....	59
N.	Claim 18: The computer readable storage medium of claim 17, wherein the code, when executed by the processor, causes the system to remove the image data of the soft tissue from the contiguous scan of the occlusal surface by generating a third occlusal backbone by removing, from the second occlusal backbone, areas representing the soft tissue.	60
O.	Claim 19: The computer readable storage medium of claim 18, wherein the code, when executed by the processor, causes the system to remove the image data of the soft tissue based at least in part on the analysis of 3D data from the contiguous scan by removing the image data of the soft tissue based at least in part on the analysis of the 3D data and at least one selected from a group consisting of a difference in color and a difference in rigidity properties.	61
P.	Explanation of Why Claims 1–6, 10–15, and 17–19 Would Have Been Obvious.....	62
1.	Difference between the claimed invention and the prior art.....	63
2.	A POSITA would have had motivation to combine the disclosures of Zhang and Babayoff.	63
3.	A POSITA would have had a reasonable expectation of success based on the disclosures of Zhang and Babayoff and knowledge generally available in the art.....	68
XI.	CLAIMS 7 AND 16 WOULD HAVE BEEN OBVIOUS OVER ZHANG IN VIEW OF BABAYOFF AND FISHER (GROUND 2).....	69

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

A.	Claim 7: The system of claim 6, wherein the processor is configured to detect the overlap based on noise characteristics of the data.	70
B.	Claim 16: The computer readable storage medium of claim 15, wherein the code, when executed by the processor, further causes the system to detect the overlap based on noise characteristics of the data.	71
C.	Explanation of Why Claims 7 and 16 Would Have Been Obvious	71
1.	Difference between the claimed invention and the prior art.....	72
2.	A POSITA would have had motivation to combine the disclosures of Zhang, Babayoff, and Fisker.	72
3.	A POSITA would have had a reasonable expectation of success based on the disclosures of Zhang, Babayoff, and Fisker and knowledge generally available in the art.	73
XII.	CLAIM 8 WOULD HAVE BEEN OBVIOUS OVER ZHANG IN VIEW OF BABAYOFF AND DILLON (GROUND 3).	75
A.	Claim 8: The system of claim 1, further comprising:	75
1.	[8.1]: a projector that projects interferometric fringes on an occlusal surface of at least a part of one arch of the dentition primarily along an anterior-posterior direction; and.....	76
2.	[8.2]: an imaging sensor that is used to view the interferometric fringes, ...	77
3.	[8.3]: wherein the processor is further configured to generate the contiguous scan of the occlusal surface based on the interferometric fringes sensed by the imaging sensor.	78
B.	Explanation of Why Claim 8 Would Have Been Obvious	79

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

1.	Difference between the claimed invention and the prior art.....	79
2.	A POSITA would have had motivation to combine the disclosures of Zhang, Babayoff, and Dillon.	79
3.	A POSITA would have had a reasonable expectation of success based on the disclosures of Zhang, Babayoff, and Dillon and knowledge generally available in the art.	80
XIII.	CLAIMS 9 AND 20 WOULD HAVE BEEN OBVIOUS OVER ZHANG IN VIEW OF BABAYOFF AND JOHNSON (GROUND 4).	82
A.	Claim 9: The system of claim 1, wherein the processor is configured to remove the image data of soft tissue from the contiguous scan of the occlusal surface based at least in part on the analysis of 3D data from the contiguous scan by distinguishing between the image data of the dentition and the image data of the soft tissue based at least in part on a comparison of surface normals of 3D structures in the contiguous scan.	82
B.	Claim 20: The computer readable storage medium of claim 10, wherein the code stored in the computer readable storage medium, when executed by the processor, cause the system to remove the image data of soft tissue from the contiguous scan of the occlusal surface based at least in part on the analysis of 3D data from the contiguous scan by distinguishing between the image data of the dentition and the image data of the soft tissue based at least in part on a comparison of surface normals of 3D structures in the contiguous scan.....	87
C.	Explanation of Why Claims 9 and 20 Would Have Been Obvious	87
1.	Difference between the claimed invention and the prior art.....	87
2.	A POSITA would have had motivation to combine the disclosures of Zhang, Babayoff, and Johnson.	88

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

3. A POSITA would have had a reasonable expectation of success based on the disclosures of Zhang, Babayoff, and Johnson and knowledge generally available in the art. 88

XIV. SECONDARY CONSIDERATIONS 90

XV. CONCLUSION.....91

APPENDIX 1

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

EXHIBIT	DESCRIPTION
1001	U.S. Patent No. 11,234,798, issued on February 1, 2022 to R. Dillon <i>et al.</i> (“the ’798 Patent”)
1002	File History of U.S. Patent Application No. 16/160,230, filed on October 15, 2018
1004	<i>Curriculum Vitae</i> of Dr. Eli Saber
1005	Declaration of Dr. Sylvia Hall-Ellis
1006	<i>Curriculum Vitae</i> of Dr. Sylvia Hall-Ellis
1007	PCT Publication No. WO 2010/077380A2, published on July 8, 2010, by H. Zhang, <i>et al.</i> (“Zhang”)
1008	Babayoff, U.S. Patent No. 7,698,068B2, issued on April 13, 2010 to N. Babayoff (“Babayoff”)
1009	PCT Publication No. WO 2013/010910A1, published on January 24, 2013, by R. Fisker, <i>et al.</i> (“Fisker”)
1010	U.S. Patent Publication No. 2012/0062701A1, published on March 15, 2012, by R Dillon, <i>et al.</i> (“Dillon”)
1011	Johnson, “Spin-Images: A Representation for 3-D Surface Matching,” published on August 13, 1997 (“Johnson”)
1012	PCT Publication No. WO 2014/049049A1, published on April 3, 2014, by C. Van Lierde, <i>et al.</i>
1014	Counterclaim Defendant 3Shape A/S’ Opening Brief on Claim Construction, filed on October 27, 2023 in <i>3Shape A/S v. Carestream Dental, LLC et al</i> , Civ. Action No. 1:22-cv-01829
1015	DITC’s Opening Claim Construction Brief Regarding the DITC Asserted Patents, filed on October 27, 2023 in <i>3Shape A/S v. Carestream Dental, LLC et al</i> , Civ. Action No. 1:22-cv-01829

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

I, Eli Saber, hereby state as follows:

I. INTRODUCTION

1. I have been retained by Buchanan Ingersoll & Rooney (“Counsel”) on behalf of 3SHAPE A/S (“Petitioner”) as an independent expert consultant in this *inter partes* review (“IPR”) proceeding before the United States Patent and Trademark Office (“PTO”).

2. I have been asked by Counsel to provide opinions regarding Claims 1–20 of United States Patent No. 11,234,798 (“the ’798 Patent”). My opinions and the bases for my opinions are set forth below.

3. I am being compensated at my ordinary and customary consulting rate for my work, which is \$450 per hour. My compensation is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of this or any other proceeding. I have no other financial interest in this proceeding.

4. This report is based on information currently available to me. I reserve the right to continue my investigation and analysis, which may include a review of documents and information not listed above. I also reserve the right to expand or otherwise modify my opinions and conclusions as my investigation and study

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

continues, and to supplement my opinions and conclusions in response to any additional information that becomes available to me.

II. BACKGROUND AND QUALIFICATIONS

5. All my opinions stated in this declaration are based on my own personal knowledge and professional judgment. In forming my opinions, I have relied on my knowledge and experience in designing, developing, researching, and teaching the technology referenced in this declaration.

6. I am over 18 years of age and, if I am called upon to do so, I would be competent to testify as to the matters set forth herein. I understand that a copy of my current curriculum vitae, which details my education and professional and academic experience, is being submitted as EX1004. The following provides a brief overview of some of my experience that is relevant to the matters set forth in this declaration.

7. I am a Professor in the Department of Electrical and Microelectronic Engineering (EME) and the Chester F. Carlson Center for Imaging Science at the Rochester Institute of Technology (RIT) in Rochester, New York. I also serve as the Director of the Image, Video and Computer Vision Laboratory. I joined RIT's full-time faculty in 2004. I have over thirty-four (34) years of industry and academic experience, thirty (30) of which are in the fields of Computer Vision, Digital Image/Video Processing, Pattern Recognition, and Machine Learning.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

8. I received a Ph.D. in Electrical Engineering from the University of Rochester in 1996. My concentration was in Signal/Image/Video Processing, Pattern Recognition, and Computer Vision. I received a Master of Science Degree in Electrical Engineering from the University of Rochester in 1992 in the same concentration as listed above, and I received a Bachelor of Science Degree in Electrical and Computer Engineering, Summa Cum Laude, from the State University of New York at Buffalo in 1988.

9. Before becoming a full-time professor, I worked for Xerox Corporation for 16 years, from 1988 to 2004. During my years at Xerox, I was responsible for delivering color management, image processing innovations, architectures, and algorithms; xerographic sub-systems for a variety of color products; and control systems for toner production facilities. One of several roles I held at Xerox was Advanced Development Scientist and Manager. In that capacity, I established the Advanced Design Laboratory—an Imaging/Xerographics lab—and provided technical and managerial leadership for the Electrical, Imaging and Xerographics Department. In another role, as Product Development Scientist and Manager, I led the research and development of image quality metrics for various product platforms. I also led the Image Science, Analysis, and Evaluation area, with 12 to 15 direct reports and a budget of approximately \$2 million.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

10. From 1997 until 2004, I was an adjunct faculty member at the Electrical Engineering Department of the Rochester Institute of Technology and at the Electrical & Computer Engineering Department of the University of Rochester. I was responsible for teaching undergraduate and graduate coursework such as Digital Signal Processing, Digital Image Processing, Digital Video Processing, Pattern Recognition, Detection and Estimation Theory and Communication Systems; and performing research in multimedia applications, pattern recognition, image understanding and color engineering.

11. Since joining RIT full time, I have been responsible for teaching several undergraduate and graduate courses in Digital Signal Processing, Digital Image Processing, Digital Video Processing, Pattern Recognition, Engineering Analysis, Random Signal & Noise, Advanced Engineering Mathematics, Matrix Methods, Communications, Modern Control Theory, and Linear Systems.

12. I proposed, developed and introduced the Digital Video Processing course and reestablished the Pattern Recognition course at the Electrical Engineering Department at RIT. These graduate courses were instrumental in providing MS/PhD students with the proper foundation and knowledge in all aspects of the subject areas in order to perform in-depth research in the field and continue to advance the state of the art.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

13. The Digital Video Processing course is designed to provide a thorough and comprehensive coverage of the field. Topics covered include the mathematical representation of digital video including motion and time-varying image formation models, spatio-temporal sampling/reconstruction, sampling structure conversions, motion estimation using optical flow, block-based, pel-recursive, Bayesian and point correspondence type methodologies, segmentation, motion tracking, filtering, restoration, super-resolution and compression.

14. The Pattern Recognition course, on the other hand, covers pertinent concepts in Bayes decision theory, linear and nonlinear classifiers, artificial neural networks, feature selection/generation/extraction and various methodologies of clustering.

15. I am currently developing a new graduate course titled: “Advanced Neural Networks and Deep Learning: Theory, Mathematics and Algorithms”. The course is intended to provide an in-depth comprehensive study of the theory, mathematics and algorithms for advanced neural networks and their usage in deep learning. It is primarily targeted for upper graduate students that are planning to pursue advanced studies/research in the field. The course provides a thorough study of shallow and deep neural networks architectures and algorithms, activation functions, backpropagation, initialization, optimization strategies, etc. It then

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

progresses to convolutional and recurrent style neural networks and, if time permits, will provide an overview of attention mechanisms/transformers and deep reinforcement learning. The course is being taught for the first time in Spring 2024.

16. My current research focuses on image/video processing for multimedia, military & biomedical applications; computer vision and three-dimensional scene reconstruction; and machine learning for object tracking/remote sensing applications. As a principal investigator (PI) or co-principal investigator, I have acquired research funding in excess of \$5.8 million since joining RIT and have managed multiple government grants from the Department of Defense as well as several corporate grants from Hewlett-Packard, Lenel, and Data Physics. I am currently managing (as PI) a multiyear government grant from the Department of Defense title “Target Detection/Tracking and Activity Recognition from Multimodal Data.” In 2012, I was awarded the Prestigious Trustees Scholarship, the highest award at RIT with regard to research recognition.

17. I am the author or co-author of thirty-eight (38) peer-reviewed journal publications.

18. I have also authored or co-authored one hundred (100) conference and workshop publications and a book entitled Advanced Linear Algebra for Engineers

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

with MATLAB, published by CRC Press in February 2009, and am a named inventor on multiple U.S. and foreign patents.

19. I am a senior member of the Institute of Electrical and Electronic Engineers and a member of the IEEE Signal Processing Society, the Electrical Engineering Honor Society, Eta Kappa Nu.

III. INFORMATION CONSIDERED

20. In preparing this declaration, I have reviewed the '798 Patent and the exhibits and documents referenced herein. In addition, my opinions are further based on my education, training, experience, and knowledge in the relevant field.

IV. RELEVANT LEGAL STANDARDS

21. I am not an attorney and offer no legal opinions. For the purposes of this Declaration, I have been informed about certain aspects of the law that are relevant to my analysis, as summarized below.

A. Claim Interpretation

22. I have been informed that during an *inter partes* review proceeding, claims are to be construed in light of the specification as would be read by a person of ordinary skill in the relevant art at the time the application was filed. I have been informed that claim terms are given their ordinary and customary meaning as would be understood by a person of ordinary skill in the relevant art in the context of the

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

entire disclosure. A claim term, however, will not receive its ordinary meaning if the patentee acted as his own lexicographer and clearly set forth a definition of the claim term in the specification. In that case, the claim term will receive the definition set forth in the patent.

B. Perspective of One of Ordinary Skill in the Art

23. I have been informed that a patent is to be understood from the perspective of a hypothetical “person of ordinary skill in the art” (“POSITA”). Such an individual is considered to possess normal skills and knowledge in a particular technical field (as opposed to being a genius). I have been informed that in considering what the claims of a patent require, what was known prior to that patent, what a prior art reference discloses, and whether an invention is obvious or not, one must use the perspective of such a POSITA.

C. Anticipation

24. I have been informed that a claim is not patentable if it is anticipated. I have been informed that anticipation of a claim requires that every element of a claim is disclosed expressly or inherently in a prior art reference, arranged as in the claim, when considered from the perspective of a person of ordinary skill in the relevant art. I have been informed that when the structure recited in a reference is substantially identical to that of the claims, claimed properties or functions are

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

presumed to be inherent. I have been informed that extrinsic evidence may be used to explain but not expand the meaning of terms and phrases used in the reference relied upon as anticipatory of the claimed subject matter.

D. Obviousness

25. I have been informed that a patent claim is obvious under 35 U.S.C. § 103, and therefore invalid, if the claimed subject matter, as a whole, would have been obvious to a POSITA as of the priority date of the patent based on one or more prior art references and/or the knowledge of a POSITA.

26. I have been informed that an obviousness analysis must consider (1) the scope and content of the prior art, (2) the differences between the claims and the prior art, (3) the level of ordinary skill in the pertinent art, and (4) secondary considerations, if any, of non-obviousness (such as unexpected results, commercial success, long- felt but unmet need, failure of others, copying by others, and skepticism of experts).

27. I have been informed that a prior art reference may be combined with other references to disclose each element of the invention under 35 U.S.C. § 103. I have been informed that a reference may also be combined with the knowledge of a POSITA, and that this knowledge may be used to combine multiple references. I have been informed that a POSITA is presumed to know the relevant prior art. I have

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

been informed that the obviousness analysis may take into account the inferences and creative steps that a POSITA would employ.

28. In determining whether a prior art reference would have been combined with other prior art or other information known to a POSITA, I have been informed that the following principles may be considered:

- whether the references to be combined involve non-analogous art;
- whether the references to be combined are in different fields of endeavor than the alleged invention in the patent;
- whether the references to be combined are reasonably pertinent to the problems to which the inventions of the patent are directed;
- whether the combination is of familiar elements according to known methods that yields predictable results;
- whether a combination involves the substitution of one known element for another that yields predictable results;
- whether the combination involves the use of a known technique to improve similar items or methods in the same way that yields predictable results;

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

- whether the combination involves the application of a known technique to a prior art reference that is ready for improvement, to yield predictable results;
 - whether the combination is “obvious to try”;
 - whether the combination involves the known work in one field of endeavor prompting variations of it for use in either the same field or a different one based on design incentives or other market forces, where the variations are predictable to a POSITA;
 - whether there is some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill in the art to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention;
 - whether the combination requires modifications that render the prior art unsatisfactory for its intended use;
 - whether the combination requires modifications that change the principle of operation of the reference;
 - whether the combination is reasonably expected to be a success;
- and

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

- whether the combination possesses the requisite degree of predictability at the time the invention was made.

29. I have been informed that in determining whether a combination of prior art references renders a claim obvious, it is helpful to consider whether there is some teaching, suggestion, or motivation to combine the references and a reasonable expectation of success in doing so. I have been informed, however, that a teaching, suggestion, or motivation to combine is not required.

V. SUMMARY OF OPINIONS

30. It is my opinion that Claims 1–20 of the '798 Patent are unpatentable under 35 U.S.C. § 103 on the following grounds:

Ground	References	Basis	Claims Challenged
1	Zhang, <i>et al.</i> , PCT Publication WO 2010/077380A2 (“Zhang”) (EX1007) in view of Babayoff, U.S. Patent 7,698,068B2 (“Babayoff”) (EX1008)	35 U.S.C. § 103	1–6, 10–15, 17–19
2	Zhang in view of Babayoff and Fisker, <i>et al.</i> , PCT Publication WO 2013/010910 A1 (“Fisker”) (EX1009)	35 U.S.C. § 103	7, 16

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

Ground	References	Basis	Claims Challenged
3	Zhang in view of Babayoff and Dillon, <i>et al.</i> , U.S. Patent Publication 2012/0062701 A1 (“Dillon”) (EX1010)	35 U.S.C. § 103	8
4	Zhang in view of Babayoff and Johnson, “Spin-Images: A Representation for 3-D Surface Matching,” 1997 (EX1011)	35 U.S.C. §103	9, 20

VI. THE CHALLENGED ’798 Patent

31. The ’798 Patent contains 20 claims. I have been asked to opine on the validity of Claims 1–20.

VII. LEVEL OF ORDINARY SKILL IN THE ART

32. I have been informed that POSITA is presumed to be aware of all pertinent art, thinks along conventional wisdom in the art, and is a person of ordinary creativity.

33. I believe that a POSITA would have at least (1) a bachelor’s degree in electrical engineering, computer engineering, or computer science (or equivalent course work) and two to three years of work experience in 3D imaging and modeling of physical structures, or (2) a master’s degree in electrical engineering, computer

engineering, or computer science (or equivalent course work) with a focus in 3D imaging and modeling of physical structures.

VIII. TECHNICAL BACKGROUND

A. The Purported Invention

34. The '798 Patent describes a computer system that generates multiple images obtained from various scans of a patient's mouth to create a three-dimensional representation of the mouth. In particular, the '798 Patent describes how multiple images from the various scans are stitched together and extraneous soft-tissue elements (such as the tongue, cheeks, and lips) are removed from the images to form a more complete 3D model of the occlusal surface of the patient's teeth.

35. The purported novelty of the invention is not 3D imaging of teeth from scans (which had been done by others in prior years), but, rather, the removal of the soft tissue components from the ultimate 3D representation. But this, too, has been done before.

B. Summary of the Applied Prior Art

36. The primary prior art cited in my declaration is Zhang (EX1007), Babayoff (EX1008), Fisker (EX1009), Dillon (EX1010), and Johnson (EX1011) which I will briefly summarize below.

1. Zhang (EX1007)

37. Zhang is a PCT application by Hong-sheng Zhang *et al.*, published on July 8, 2010. EX1007. It describes a computer system for creating three-dimensional images of dentition (teeth) in the mouth of a patient using a camera in a hand-held scanning device. The operator moves the scanner above and around the teeth in a patient's mouth while the scanner acquires images of the teeth and soft tissue in the mouth.

38. Using those images, which can be acquired in multiple scans, the computer system analyzes them and determines how to stitch them together to create a 3D reconstruction of the teeth, which can be displayed in real time on a screen.

2. Babayoff (EX1008)

39. Babayoff is a US Patent that issued on April 13, 2010 to Noam Babayoff. EX1008. Like Zhang, it also describes a computer system for creating three-dimensional images of dentition (teeth) in the mouth of a patient using a camera in a hand-held scanning device. It also uses a hand-held scanner with a camera to obtain color images of the teeth and soft tissue in the patient's mouth in multiple scans.

40. It also uses those color images to create a 3D representation of the teeth. It first analyzes the images to stitch them together to create the 3D representation. It

then distinguishes and removes the soft tissue from the 3D representation, using parameters such as the color differences between a tooth and soft tissue to do so.

3. Fisker (EX1009)

41. Fisker is a PCT patent publication by Rune Fisker *et al.* that published on January 24, 2013, which is based on an application filed on an international filing on July 12, 2012 that claimed priority to applications filed in Germany and the United States on July 15, 2011. EX1009.

42. Fisker describes a method and system for detecting movable objects (such as the patient's cheek, tongue, etc.) in a patient's mouth during a 3D scan and then excluding those movable objects from the ultimate 3D reconstruction of the patient's teeth. Like the other references, Fisker uses a hand-held scanner that is inserted into the patient's mouth and is connected to a computer that processes the scanned data.

4. Dillon (EX1010)

43. Dillon is a US patent publication by Robert Dillon *et al.* that published on March 15, 2012, which is based on an application filed on August 25, 2011. EX1010.

44. Dillon describes a hand-held scanner that projects interferometric fringes onto a patient's teeth and then uses images of those fringes to reconstruct a 3D representation of the patient's teeth.

5. Johnson (EX1011)

45. Johnson is a doctoral thesis by Andrew E. Johnson from Carnegie Mellon University entitled "Spin-Images: A Representation for 3-D Surface Modeling" and dated August 13, 1997.

46. Johnson describes a process that compares surfaces of 3D objects to distinguish between similar and dissimilar features on the surfaces. Johnson utilizes spin-images in his technique, which includes the use of surface normals, to distinguish between dissimilar features.

47. The techniques described by Johnson have been used by others in the intra-oral scanning context to distinguish features in patient's mouths. *See, e.g.*, EX1012, 2:9–3:23.

IX. CLAIM CONSTRUCTION

48. For purposes of my analysis in this IPR proceeding, I have been informed that terms that appear in the claims of the '798 Patent should be interpreted according to their plain and ordinary meaning under the *Phillips* standard. In determining the ordinary and customary meaning, I have been informed that the

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

words of a claim are first given their plain meaning that those words would have had to a POSITA at the time of the alleged invention. I also have been informed that the claims, specification, and file history may be used to better construe a claim insofar as the plain meaning of the claims cannot be understood. I have been informed that even treatises and dictionaries may be used under limited circumstances to determine the meaning attributed by a POSITA to a claim term at the time of filing.

49. I note that the constructions of some claim terms are disputed in the Related Litigation. Petitioner asserted that the terms “image data” (Claims 1, 9, 10, 18–20), “image frames” (Claims 1, 3, 10, 14), and the entirety of element [1.6] are indefinite, while the Patent Owner asserted that these terms should be given their plain and ordinary meaning. Exs1015, 1014. While the proper metes and bounds of these terms are disputed, the cited prior art falls within these bounds whatever they may be.

50. Petitioner also asserted that “occlusal surface” (Claims 1–4, 6, 8–12, 14, 15, 18, 20) means “the biting surface of a patient’s teeth”; the “contiguous scan” terms (Claims 1, 3, 10, 14) mean “a scan of an/the occlusal surface made in a single, uninterrupted motion of the scanning wand”; and the “additional surface” terms (Claims 1–3, 6, 8–11, 14, 15, 18–20) mean “a subsequent additional scan of a surface (e.g. labial, lingual surface) to the contiguous scan of the occlusal surface.” EX1014.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

Patent Owner asserted that they all should be given their plain and ordinary meaning.
EX1015.

51. I have reviewed the '798 Patent and its prosecution history as well as additional documents and have considered the parties' proposed constructions, as well as a plain-meaning understanding, for each claim term.

52. I believe that resolution of this Petition does not depend on which constructions are used because these features of the claims are disclosed by the prior art regardless of the construction.

X. Claims 1–6, 10–15, and 17–19 Would Have Been Obvious Over Zhang in View of Babayoff (Ground 1).

53. In my opinion, Claims 1–6, 10–15, and 17–19 are unpatentable over the prior art of Zhang and Babayoff.

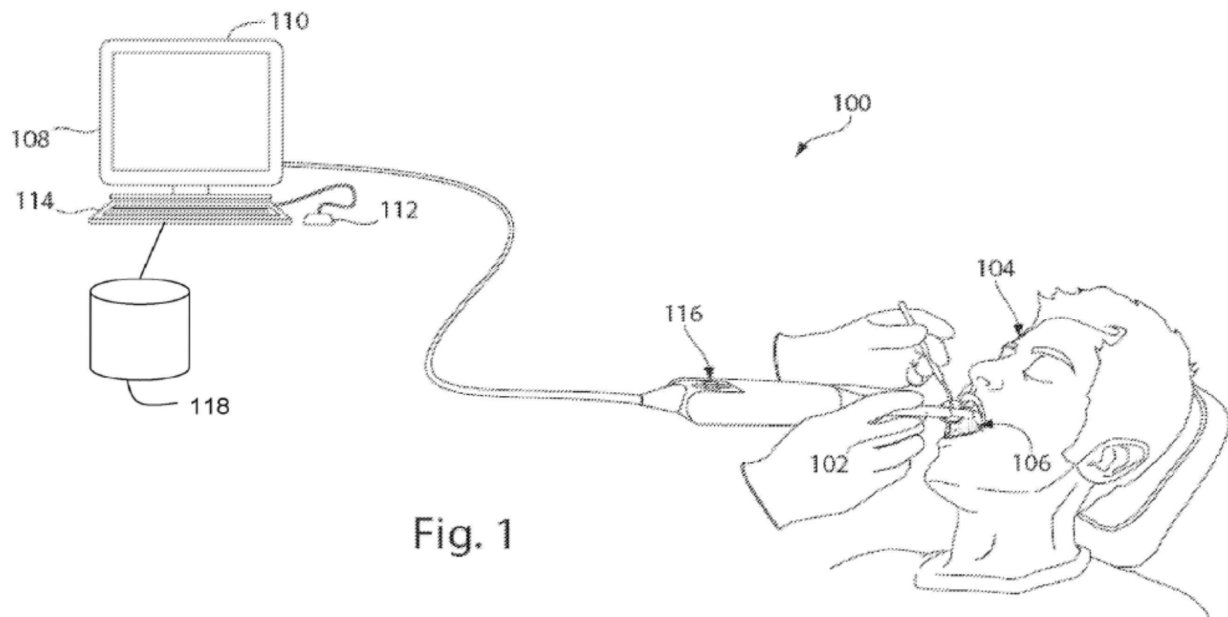
54. The following sections explain where each element of these claims is found in this prior art.

A. Claim 1 (Preamble): A system for generating an intra-oral scan of dentition, the system comprising:

55. The preamble of Claim 1 is disclosed in Zhang (EX1007) and Babayoff (EX1008).

56. In the context of the '798 Patent, “dentition refers to the arrangement of teeth [i]n the oral cavity of a patient.” EX1001, 12:3–4.

57. Zhang describes a scanning system 100 for creating a 3D reconstruction of dental objects. EX1007, ¶[0041], Fig. 1. “[T]he system 100 may include a scanner 102 that captures images from a surface 106 of an object 104, such as a dental patient, and forwards the images to a computer 108, which may include a display 110....” *Id.*



58. “Dental objects,” as defined in Zhang, include intraoral structures, such as dentition. *Id.*, ¶[0038] (“The term ‘dental object’, as used herein, is intended to refer broadly to subject matter related to dentistry. This may include intraoral structures such as dentition, and more typically human dentition, such as individual teeth, quadrants, full arches, pairs of arches ..., soft tissue, and the like, as well as bones and other supporting or surrounding structures.”).

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

59. Babayoff also discloses a system that scans intra-oral cavities, including both hard tissue (teeth, or dentition) and soft tissue (gums, cheeks, and tongue) contained within them. EX1008, 4:37–39, 6:32–47, 7:53–8:22, 28:8–24.

60. In my opinion, to the extent that the preamble is limiting, both Zhang and Babayoff disclose a system for generating scans of intraoral structures (dentition).

1. [1.1]: a memory; and

61. Element [1.1] is disclosed in Zhang (EX1007) and Babayoff (EX1008).

62. Zhang discloses that the system 100 includes memory. EX1007, ¶[0050] (“The system 100 may include a computer-usable or computer-readable medium. The computer-usable medium 118 may include one or more memory chips (or other chips, such as a processor, that include memory) ...”), ¶[0046] (“In one embodiment, the computer 108 includes a personal computer with ... 2 gigabytes of random access memory...”).

63. Similarly, Babayoff discloses that his system includes memory. EX1008, 6:42 (“a memory utility for storing the data”), 28:20.

64. In my opinion, both Zhang and Babayoff disclose the requirements of Element [1.1]—the system has a memory.

2. [1.2]: a processor coupled to the memory, wherein the processor is configured to:

65. Element [1.2] is disclosed in Zhang (EX1007) and Babayoff (EX1008).

66. Zhang discloses that the computer 108 in system 100 includes a processor coupled to the memory. EX1007, ¶[0046] (“In one embodiment, the computer 108 includes a personal computer with a dual 2.8 GHz Opteron central processing unit, 2 gigabytes of random access memory ...”), ¶[0100] (“[A]ny of the above system and/or methods may be realized in hardware, software, or any combination of these suitable for the data acquisition and modeling technologies described herein. This includes realization in one or more microprocessors, microcontrollers, embedded microcontrollers, programmable digital signal processors or other programmable devices, along with internal and/or external memory”).

67. Babayoff also discloses a processor coupled to the memory for manipulating the information stored in the memory. EX1008, 6:43–46 (“a processor utility for manipulating said first data set to provide desired data therefrom ...”), 28:21–23.

68. In my opinion, both Zhang and Babayoff disclose all the requirements of Element [1.2]—the system has a processor coupled to the memory.

3. [1.3]: generate a contiguous scan of an occlusal surface of at least a part of one arch of dentition,

69. Element [1.3] is disclosed in Zhang (EX1007).

70. This element requires the creation of a contiguous scan of an occlusal surface that includes at least part of one arch.

71. Zhang discloses that system *100* is capable of creating a contiguous scan of dental objects (which includes occlusal surfaces and arches), which meets the requirements of this element. It also specifically notes that the information obtained from scanner *102* is sent to computer *108*, which contains a processor that analyzes and processes the information, to create the scan. EX1007, ¶¶[0041], [0046].

72. Zhang discloses how the scanner *102* can take contiguous scans through a continuous/uninterrupted data acquisition process. *Id.*, ¶[0043] (“The scanner 102 may, through such a continuous data acquisition process, capture a point cloud of surface data having sufficient spatial resolution and accuracy to prepare dental objects such as prosthetics, hardware, appliances, and the like therefrom, either directly or through a variety of intermediate processing steps.”).

73. Zhang further explicitly discloses that these scans can be of an occlusal surface. *Id.*, ¶[0098] (“intra-oral scanning often employs a number of adjacent, relatively straight global paths such as for lingual, occlusal, and buccal surfaces”),

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

¶[0090] (“For example, where a scan path covers a buccal surface followed by an occlusal or lingual surface, many spatial links might be identified between non-contiguous [sic] camera path segments associated with each surface.”).

74. Zhang also discloses that the scan of these surfaces can include dentition such as arches. *Id.*, ¶[0045] (“A scan may capture a three-dimensional representation of some or all of the dentition according to particular purpose of the scan. Thus, the scan may capture a digital model of a tooth, a quadrant of teeth, or a full collection of teeth including two opposing arches, as well as soft tissue or any other relevant intraoral structures.”).

75. In my opinion, Zhang discloses all the requirements of Element [1.3]—the processor generates a contiguous scan of the occlusal surface that includes arches.

4. **[1.4]: remove image data of soft tissue from the contiguous scan of the occlusal surface based at least in part on an analysis of 3D data from the contiguous scan to distinguish between image data of the dentition and the image data of the soft tissue, wherein the soft tissue includes at least one selected from a group consisting of a tongue, a cheek, and a lip, and**

76. Element [1.4] is disclosed in Zhang (EX1007) and Babayoff (EX1008).

77. This element has multiple parts: (1) 3D image data from the contiguous scan of the occlusal surface includes image data of both soft tissue and dentition; (2)

the soft tissue is the tongue, cheek, or lip; (3) the 3D image data is analyzed to distinguish between soft tissue and dentition, and (4) the soft tissue image data is then removed from the contiguous scan of the occlusal surface based on this analysis. The occlusal surface of a tooth is at the top of the tooth (the chewing surface).

78. Zhang discloses that the contiguous scan data can include soft tissue and dentition (EX1007, ¶[0045] (“the scan may capture a digital model of a tooth, a quadrant of teeth, or a full collection of teeth including two opposing arches, as well as soft tissue”) and that the scan data can create a 3D model of the dental object, which includes soft tissue (*id.*, ¶[0014] (“The three-dimensional model of the dental object may include one or more of gums and soft tissue”))).

79. Babayoff also discloses scans of soft tissue and dentition to obtain 3D data:

There are also procedures in which particularly good three-dimensional definition of a large area of the intraoral cavity is required, and it may be necessary at times to scan parts of the cavity sequentially and then “stitch” the various data sets together.... the data sets often include surface data relating to the soft tissues such as gums, cheeks and tongue, for example....

EX1008, 2:1–18.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

80. Babayoff further discloses that soft tissue image data may be separated or removed from the hard tissue¹ data, using color information from the images, for example. *Id.*, 5:11–16 (“By eliminating the data associated with the soft tissues, and proceeding with stitching only the hard tissues using the color data, the quality of the stitching procedure is significantly better than when using the full intra-oral data for the stitching procedure”); 23:34–36 (“separation of the hard tissue from the soft tissue results in a smaller database that needs to be analysed to identify the finish line”); 24:36–40 (“The data in these entities not corresponding to the hard tissues may de [sic] discarded or simply noted and set aside for future reference, thereby providing modified entities (IS'₁, IS'₂, ... IS'_n) comprising the data of interest relating to the hard tissues, for example”); 26:4–7 (“The method according to this embodiment may be modified to separate the soft tissues from the hard tissues, once the demarcation line between the two tissues is known, as determined above”). Babayoff describes how this removal process may be accomplished using color data. *Id.*, 22:11–61, 24:25–47.

81. Babayoff notes how the processor is part of the system that processes the image data. *Id.*, 8:30–66, 9:63–10:28.

¹ Babayoff defines hard tissue to include the teeth (dentition). EX1008, 21:6–7.

82. In my opinion, Zhang in combination with Babayoff discloses all the requirements of Element [1.4]—a contiguous scan of the occlusal surface that includes 3D image data of both soft tissue and dentition, where the soft tissue can include the tongue or cheek, and where image data is analyzed to distinguish between the soft tissue and dentition (hard tissue) so that the soft tissue image data can be removed.

5. [1.5]: associate a scan of at least one additional surface to the contiguous scan of the occlusal surface by

83. Element [1.5] is disclosed in Zhang (EX1007).

84. As used in the '798 Patent, the term “additional surface” refers to a surface of the teeth that is not the occlusal surface, such as labial and lingual surfaces. EX1001, 8:2–4 (“the at least one additional surface comprises a plurality of labial surfaces and lingual surfaces”).

85. Typically, labial refers to the surface of the teeth in the front of the mouth that are facing the lips, while lingual refers to the surface of the tooth facing the tongue. Buccal is similar to labial but refers to the surface of the tooth further back in the mouth that faces the cheeks. From the context of the '798 Patent, it is

clear that the labial surface, as used in the patent, includes the buccal surface, as well.²

86. This element, therefore, requires associating scans of a lingual or labial surface with the scan of the occlusal surface.

87. Zhang discloses that subsequent scans of various surfaces (additional data sets) are connected (or associated) with one another to form more complete 3D information about the teeth. EX1007, ¶[0094] (“After path optimization is complete, additional three-dimensional data may be added based upon the one or more additional data sets and the one or more additional poses from between key frames”).

88. The subsequent scans (additional data sets) can include one of the occlusal surface and others of the buccal/labial and lingual surfaces or from additional data sets. *Id.*, ¶[0098] (“intra-oral scanning often employs a number of adjacent, relatively straight global paths such as for lingual, occlusal, and buccal

² For instance, Figures 2 and 3 of the '798 Patent reference the labial scan as being of all the teeth surfaces facing away from the tongue, and not just those near the lips. EX1007. Nothing in the patent suggests that the buccal surfaces are somehow excluded from scans or the ultimate 3D reconstruction, which consists of all the teeth in the mouth.

surfaces”). These additional data sets can then be related to one another (i.e., associated with each other) to form a 3D representation. *Id.*, ¶[0095] (“Thus for example two data sets from buccal and lingual scan segment may be related to one another based upon camera position, the three-dimensional data recovered from the respective data sets, or any other data acquired during a scanning process.”).

89. In my opinion, Zhang discloses all the requirements of Element [1.5]—the scans of additional surfaces are associated with the contiguous scan of the occlusal surface.

6. [1.6]: analyzing the scan data to identify a portion of the scan of the at least one additional surface that overlaps with a portion of the contiguous scan of the occlusal surface,

90. Element [1.6] is disclosed in Zhang (EX1007) and Babayoff (EX1008).

91. This element requires analyzing scan data to identify overlaps between the additional surfaces (lingual and labial) and the occlusal surface.

92. Zhang describes how his system analyzes the scan data to link images from different parts of the mouth by finding overlaps in images. EX1007, ¶[0015] (“Identifying at least one non-sequential spatial link may include identifying the at least one non-sequential spatial link based upon an overlap in three-dimensional data reconstructed from the data set for each of the two nonsequential ones of the poses”), ¶[0065] (“Key frames may also or instead be selected based upon an amount of

image overlap from the preceding key frame and/or a candidate for a following key frame (if available)").

93. Zhang further notes that the scan data can include images of the occlusal surface and lingual surface (i.e., an additional surface). *Id.*, ¶[0098] ("intra-oral scanning often employs a number of adjacent, relatively straight global paths such as for lingual, occlusal, and buccal surfaces").

94. Babayoff also discloses how multiple data sets (scans of the hard tissue in the intraoral cavity, e.g., teeth) are analyzed to determine overlaps in the data so that they can be properly stitched together. EX1008, 4:50–67.

95. In my opinion, Zhang and Babayoff disclose all the requirements of Element [1.6]—the scan data is analyzed to identify overlaps between the additional surface (lingual surface) and the occlusal surface.

7. **[1.7]: wherein the scan of the at least one additional surface includes a sequence of image frames including a plurality of image frames of the occlusal surface interspersed with a plurality of image frames of the at least one additional surface, and**

96. Element [1.7] is disclosed in Zhang (EX1007).

97. This element requires that the scan of the additional surface be comprised of a sequence of images (the image frames) that include images of both the occlusal and additional surfaces.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

98. Zhang discloses how the scans are comprised of a sequence of images (which he calls “frames”) of the surfaces. EX1007, ¶[0064] (“The process 700³ may begin with preprocessing as shown in step 710. It will be understood that preprocessing as described herein presupposes the availability of a number of frames of image data from which a camera path and three-dimensional model can be reconstructed.”); ¶[0065] (“key frames may be selected from among all of the frames of data acquired from the scanner along a camera path”).

99. Zhang further discloses that scan paths can obtain images of multiple types of surfaces (e.g., occlusal, lingual, and buccal) in the same scan. *Id.*, ¶[0090] (“where a scan path covers a buccal surface followed by an occlusal or lingual surface, many spatial links might be identified between non-contiguous [sic] camera path segments associated with each surface”). And the scanning in Zhang contemplates that there will be significant overlaps between successive images in the scans, which allows them to be linked together to form a complete 3D model of the teeth. *Id.*, ¶[0065] (“In principle, these key frames should be related to one

³ By “process 700,” Zhang means the process of creating a 3D reconstruction of the teeth. EX1007, ¶[0063].

another in a manner that permits characterization of a camera path, typically through the registration of overlapping three-dimensional data in respective key frames”).

100. In my opinion, Zhang discloses all the requirements of Element [1.7]—the scan of an additional surface (lingual surface) includes sequences of images of both the additional surface and the occlusal surface.

8. [1.8]: determining a position of the scan of the at least one additional surface relative to the scan of the occlusal surface based on the identified overlapping portions,

101. Element [1.8] is disclosed in Zhang (EX1007).

102. This element requires determining the relative positions of scans of an additional surface with the scan of the occlusal surface by using overlaps in the two scans.

103. Zhang discloses how scans of different surfaces are related to one another based on 3D data from each scan. EX1007, ¶[0095] (“Thus for example two data sets from a buccal and lingual scan segment may be related to one another based upon camera position, the three-dimensional data recovered from the respective data sets”). While referring to just the buccal and lingual scans in that example, Zhang makes clear that separate scans of lingual, occlusal, and buccal surfaces are used to create the ultimate 3D reconstruction. *Id.*, ¶[0098] (“intra-oral scanning often employs a number of adjacent, relatively straight global paths such as for lingual,

occlusal, and buccal surfaces”); ¶[0097] (“a three-dimensional model of the dental object may be reconstructed using known techniques based on the optimized camera path and the plurality of data sets”).

104. Zhang further describes how this relationship is based on overlaps found in key frames (portions) of the scans.

[T]hese key frames should be related to one another in a manner that permits characterization of a camera path, typically through the registration of overlapping three-dimensional data in respective key frames. Various methods are known in the art for selecting a subset of frames of data as key frames, including techniques based on image overlap, camera path distance, the number of intervening non-key frames and so forth. For example, key frames may be selected based on time duration from an immediately preceding key frame. Key frames may also or instead be selected based upon an amount of image overlap from the preceding key frame and/or a candidate for a following key frame (if available). Too little overlap makes frame-to-frame registration difficult. Too much overlap drives larger numbers of key frames and therefore larger amounts of data to analyze. Key frames may be selected based on spatial displacement, meaning that an upper limit may be placed on the amount of overlap from one key frame to the next.

Id., ¶[0065].

105. Zhang then explains that positional data is obtained from these overlapping key frames of the surfaces. *Id.*, ¶[0066] (“Once key frames have been selected, additional processing may be performed. For example, full image data (e.g., full resolution center and side channel images) may be stored for each key frame, along with image signature data, point cloud centroid calculations, and any other measured or calculated data to support use of the key frames in a three-dimensional reconstruction process as described herein.”).

106. In my opinion, Zhang discloses all the requirements of Element [1.8]—the position of the scans of the additional surface and the occlusal surface is determined through the overlapping portions of that data.

9. **[1.9]: wherein the processor is configured to generate the contiguous scan of the occlusal surface by capturing a plurality of partially overlapping image frames of the occlusal surface and stitching the overlapping image frames together to form a 3D model of the occlusal surface,**

107. Element [1.9] is disclosed in Zhang (EX1007).

108. This element requires that the processor generates a contiguous scan of the occlusal surface by capturing a sequence of overlapping images of the occlusal surface and stitching them together to form a 3D model of the occlusal surface.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

109. Zhang discloses how scanner 102 and computer 108 (which includes the processor) are coupled together and that the system captures the images obtained from the scanner. EX1007, ¶[0047] (“Communications between the computer 108 and the scanner 102 may use any suitable communications link”); ¶[0046] (“the system can be operated to capture more than five thousand point per image set in real time”).

110. The system captures scan data in a continuous process as the scanner moves along a surface in the patient’s mouth. *Id.*, ¶[0043] (“the scanner may be shaped and sized for intraoral scanning and data capture, such as by insertion into a mouth of an imaging subject and passing over an intraoral surface 106 at a suitable distance to acquire surface data from teeth, gums, and so forth. The scanner 102 may, through such a continuous data acquisition process, capture a point cloud of surface data having sufficient spatial resolution and accuracy to prepare dental objects such as prosthetics, hardware, appliances, and the like therefrom, either directly or through a variety of intermediate processing steps.”).

111. This scan data includes images. *Id.*, ¶[0048] (“In an example of general operation of a three-dimensional image capture system 100, the scanner 102 may acquire two-dimensional image sets at a video rate while the scanner 102 is passed over a surface of the subject”). And Zhang specifically characterizes individual

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

images as “frames.” *Id.*, ¶[0055] (“The real-time processing controller 316 may provide images or frames to the high-speed (video rate) processing pipeline 330 for reconstruction of three-dimensional surfaces from the two-dimensional source data in real time”).

112. One of the data sets acquired in Zhang is a contiguous scan (scan path) of the occlusal surface. *Id.*, ¶[0090] (“where a scan path covers a buccal surface followed by an occlusal or lingual surface, many spatial links might be identified between non-contiguous [sic] camera path segments associated with each surface”).

113. Zhang then discusses how these overlapping image frames are stitched together to form a 3D representation of the patient’s teeth. *Id.*, ¶[0003] (“In one technique for three-dimensional image reconstruction, a number of images or image sets of an object are captured with a camera that travels in a path over the surface of the object. Information from this catalogue of information can then be used to reconstruct a three-dimensional model of the object based upon the camera path and individual three-dimensional measurements captured along the camera path.”); ¶[0048] (“The three-dimensional data for each newly acquired two-dimensional image set may be derived and fitted or ‘stitched’ to existing three-dimensional data using a number of different techniques”); ¶[0055] (“The three-dimensional point

clouds from individual image sets may be combined by a three-dimensional stitching module 336. Finally, the stitched measurements may be combined into an integrated three-dimensional model by a three-dimensional model creation module 338.”); ¶[0056] (“key frames should be related to one another in a manner that permits characterization of a camera path, typically through the registration of overlapping three-dimensional data in respective key frames”).

114. In my opinion, Zhang, discloses all the requirements of Element 1.9]—the system, through the scanner, computer, and processor, generates a contiguous scan of the occlusal surface by capturing a series of overlapping images, which are then stitched together to form a 3D representation of the patient’s teeth.

10. [1.10]: wherein the processor is configured to remove the image data of the soft tissue from the contiguous scan by removing the image data of the soft tissue from the overlapping image frames used to generate the occlusal scan, and

115. Element [1.10] is disclosed in Babayoff (EX1008).

116. This element requires the processor to remove image data of the soft tissue from the overall scan by removing it from the overlapping images that generated the scan.

117. As discussed above in § X(A)(4), Babayoff discloses a procedure that separates or removes soft tissue image data from hard tissue data. EX1008, 5:11–16

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

(“By eliminating the data associated with the soft tissues, and proceeding with stitching only the hard tissues using the color data, the quality of the stitching procedure is significantly better than when using the full intra-oral data for the stitching procedure”); 23:34–36 (“separation of the hard tissue from the soft tissue results in a smaller database that needs to be analysed to identify the finish line”); 24:36–40 (“The data in these entities not corresponding to the hard tissues may be [sic] discarded or simply noted and set aside for future reference, thereby providing modified entities (IS'₁, IS'₂, ... IS'_n) comprising the data of interest relating to the hard tissues, for example”); 26:4–7 (“The method according to this embodiment may be modified to separate the soft tissues from the hard tissues, once the demarcation line between the two tissues is known, as determined above”). Babayoff describes how this removal process may be accomplished using color data. *Id.*, 22:11–61, 24:25–47.

118. Babayoff also notes how the processor is part of the system that processes the image data. *Id.*, 8:30–66, 9:63–10:28.

119. In my opinion, Babayoff, discloses all the requirements of Element 1.10—it uses a processor to remove image data of soft tissues from the overall scan data of the intraoral cavity (the occlusal surface) by removing this information from the overlapping scan data used to create the overall scan data.

- 11. [1.11]: wherein the processor is further configured to update the contiguous scan of the occlusal surface by restitching the overlapping image frames together after removing the image data of the soft tissue to form an updated 3D model of the occlusal surface.**

120. Element [1.11] is disclosed in Babayoff (EX1008).

121. This element requires the processor to replace the original scan of the occlusal surface of the teeth by restitching the overlapping image frames after the image data of the soft tissue has been removed to create an updated 3D model of the occlusal surface.

122. Babayoff discloses such a system in one of its embodiments. As described more fully in Columns 23–26 of Babayoff, the system “for accurately stitching data sets of overlapping area scanned within the intra-oral cavity” (EX1008, 23:50–51) by removing the portions of the image corresponding to the soft tissue and then restitching the remaining image data of the hard tissue (the teeth) to create a more accurate model of the intra-oral cavity.

123. Babayoff discloses that the first step is to take the scan data of overlapping areas in the intra-oral cavity, including its topography and color, and stitch it together to create a 3D model of the intra-oral cavity. *Id.*, 23:49–24:5 (“the various entities stitched together or combined to form a global numerical entity...”).

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

124. The second step involves differentiating the hard tissue from the soft tissue. *Id.*, 24:29–32 (“Accordingly, in a second step 1220 of the method, the hard tissues including the teeth, fillings and prostheses are differentiated from the soft tissues including the gums, cheeks, lips and tongue.”). Next, the method discards the information associated with the soft tissue. *Id.*, 24:36–40 (“The data in these entities not corresponding to the hard tissues may de [sic] discarded or simply noted and set aside for future reference.”).

125. Finally, the third step involves taking the remaining data (without the soft tissue) and stitching it again (i.e., restitching) to form a model of the hard tissue (e.g., the occlusal surface). *Id.*, 24:41–47 (“In the next step 1230 of the method, the modified entities (IS'_1 , IS'_2 , ... IS'_n) are then manipulated in a similar manner in which the original entities (I_1 , I_2 , ... I_n) are manipulated in the prior art, mutatis mutandis, to register and then stitch the various modified entities (IS'_1 , IS'_2 , ... IS'_n) together to provide a composite entity I' that comprises the data points corresponding at least to the hard tissues.”).

126. In my opinion, Babayoff, discloses all the requirements of Element [1.11]—it updates the scan of the occlusal surface (the hard tissue) by restitching the overlapping image data of the occlusal surface after removing the image data of the soft tissue.

- B. Claim 2: The system of claim 1, wherein the processor is further configured to associate a plurality of scans of additional surfaces to the contiguous scan of the occlusal surface, wherein the plurality of scans of the additional surfaces includes a plurality of scans of labial surfaces and a plurality of scans of lingual surfaces.**

127. Claim 2 is disclosed in Zhang (EX1007).

128. This dependent claim further refines Element [1.5] by requiring that the processor associate multiple scans of both the labial and lingual surfaces with the contiguous scan of the occlusal surface, instead of just one scan of those surfaces.

129. As stated above in § X(A)(5), the system in Zhang discloses that a plurality (“one or more”) scans of various surfaces (“additional data sets”) are associated with one another to form more complete 3D information about the patient’s teeth. EX1007, ¶[0094] (“After path optimization is complete, additional three-dimensional data may be added based upon the one or more additional data sets and the one or more additional poses from between key frames”).

130. The plurality of scans (additional data sets) can include the occlusal, buccal/labial, and lingual surfaces. *Id.*, ¶[0098] (“intra-oral scanning often employs a number of adjacent, relatively straight global paths such as for lingual, occlusal, and buccal surfaces”). These additional data sets are associated with one another to form a 3D representation. *Id.*, ¶[0095] (“Thus for example two data sets from buccal and lingual scan segment may be related to one another based upon camera position,

the three-dimensional data recovered from the respective data sets, or any other data acquired during a scanning process”).

131. In my opinion, Zhang discloses all the requirements of Claim 2—multiple scans of the labial and lingual surfaces are associated with the contiguous scan of the occlusal surface.

C. Claim 3: The system of claim 1,

- 1. [3.1]: wherein the plurality of image frames of the occlusal surface from the scan of the at least one additional surface each overlap with the contiguous scan of the occlusal surface,**

132. Element [3.1] is disclosed in Zhang (EX1007).

133. As discussed above in § X(A)(7), Zhang discloses how the scans are comprised of a sequence of images (which he calls “frames”) of the surfaces. EX1007, ¶[0064] (“It will be understood that preprocessing as described herein presupposes the availability of a number of frames of image data from which a camera path and three-dimensional model can be reconstructed.”); ¶[0065] (“key frames may be selected from among all of the frames of data acquired from the scanner along a camera path.”).

134. Zhang further discloses that scan paths can obtain images of multiple types of surfaces (e.g., occlusal, lingual, and buccal) in the same scan. *Id.*, ¶[0090] (“where a scan path covers a buccal surface followed by an occlusal or lingual

surface, many spatial links might be identified between non-contiguous [sic] camera path segments associated with each surface”). And the scanning in Zhang contemplates that there will be significant overlaps between successive images in the scans, which allows them to be linked together to form a complete 3D model of the teeth. *Id.*, ¶[0065] (“In principle, these key frames should be related to one another in a manner that permits characterization of a camera path, typically through the registration of overlapping three-dimensional data in respective key frames”).

135. In my opinion, Zhang discloses all the requirements of Element [3.1]—image frames from a scan of an additional surface can include image frames of the occlusal surfaces and that these image frames can overlap with images from the contiguous scan of the occlusal surface.

2. [3.2]: wherein the plurality of images frames of the at least on[e] additional surface includes image frames of a labial or lingual surface, and

136. Element [3.2] is disclosed in Zhang (EX1007).

137. As stated above in § X(A)(7), the scans of the additional surfaces in Zhang include multiple images frames of the lingual and buccal/labial surfaces, which satisfies this element. EX1007, ¶¶[0064], [0065], [0090].

3. **[3.3]: wherein the processor is configured to use the plurality of image frames of the occlusal surface that is included in the scan of the at least one additional surface to determine a position of the image frames of the labial or lingual surface relative to the contiguous scan of the occlusal surface.**

138. Element [3.3] is disclosed in Zhang (EX1007).

139. Zhang discloses the system uses multiple image frames of the scans of the occlusal, lingual, and labial/buccal surfaces to determine the position of the images relative to one another and the scan of the occlusal surface.

140. Zhang describes how “spatial link data,” which “reflects the physical camera path in the order in which data was acquired ... characterize[s] the camera path during a data acquisition process.” EX1007, ¶[0094]. This spatial link data may be a “sequence of poses ... made up of key frames (or sequential pairs of key frames)” from “additional data sets” (e.g., the occlusal, labial/buccal/and lingual surfaces). *Id.*

141. These spatial links can then be related to one another based on information from the scans. “Thus for example two data sets from a buccal and lingual scan segment may be related to one another based upon camera position, the three-dimensional data recovered from the respective data sets, or any other data acquired during a scanning process.” *Id.*

142. While Zhang provides a specific example that relates the buccal and lingual scans, the methodology applies to linking any of the surfaces together (e.g., occlusal with labial or lingual). *Id.*, ¶[0097] (“a three-dimensional model of the dental object may be reconstructed using known techniques based upon the optimized camera path and the plurality of data sets”).

143. In my opinion, Zhang, discloses all the requirements of Element [3.3]—the processor uses multiple image frames of the scan of the occlusal and an additional surface (lingual or labial/buccal surfaces) to determine the position of the labial or lingual images relative to the contiguous scan of the occlusal surface.

D. Claim 4: The system of claim 2, wherein the occlusal surface is imaged prior to the plurality of labial and lingual surfaces, and wherein the processor is further configured to display in real-time a three-dimensional representation of the dentition as the plurality of labial and lingual surfaces are imaged.

144. Claim 4 is disclosed in Zhang (EX1007).

145. This dependent claim requires that the occlusal surface is imaged before the labial and lingual surfaces and further that a 3D representation of the patient’s dentition is displayed in real time as the labial and lingual surfaces are imaged.

146. Zhang allows the user to scan any surfaces in the intraoral cavity. EX1007, ¶[0045] (“A scan may capture a three-dimensional representation of some or all of the dentition according to particular purpose of the scan”), ¶58. In my

opinion, the choice of imaging the occlusal surface first from the three types of available surfaces (occlusal, labial, and lingual) would be an obvious choice.

147. Zhang describes how his device provides 3D data in real-time. *Id.*, ¶[0054] (“the high-speed processing pipeline 330 aims to provide three-dimensional data in real time, such as at a video frame rate used by an associated display”); ¶[0055] (“The real-time processing controller 316 may provide images or frames to the high-speed (video rate) processing pipeline 330 for reconstruction of three-dimensional surfaces from the two-dimensional source data in real time”).

148. In my opinion, Zhang discloses all the requirements of Claim 4—the occlusal surface is imaged before the labial and lingual surfaces and further that the processor displays a 3D representation of the patient’s dentition in real time as the labial and lingual surfaces are imaged.

E. Claim 5: The system of claim 4,

- 1. [5.1]: wherein the processor is configured to display in real-time the three-dimensional representation of the dentition by performing a coarse matching by matching features as the plurality of labial and lingual surfaces are imaged, and**

149. Element [5.1] is disclosed in Zhang (EX1007).

150. The element requires that the processor display a real-time coarse 3D representation of the teeth by roughly matching features from the multiple labial and lingual surfaces that were imaged.

151. Zhang discloses that the real-time processing controller creates a coarse, high-speed 3D representation of the teeth based on images of the various surfaces in real time (as contrasted with full resolution, *high-accuracy* 3D representations created in another part of the system). EX1007, ¶¶[0054]–[0055]. The images include images of the labial and buccal/lingual surfaces. *Id.*, ¶[0098].

152. The 3D representation is based on 3D point cloud information created from stitching together information based on multiple images of the tooth surfaces to create a 3D model of the teeth. *Id.*, ¶¶[0035], [0048], [0055].

153. The system then displays this 3D representation on display 110. *Id.*, ¶¶[0049], [0054]–[0055].

154. In my opinion, Zhang discloses all the requirements of Element [5.1]—the processor display a real-time coarse 3D representation of the teeth by roughly matching features from the multiple labial and lingual surfaces that were imaged.

2. [5.2]: wherein the processor is further configured to generate a three-dimensional reconstruction of the dentition based on a point cloud alignment after the plurality of labial and lingual surfaces are all imaged.

155. Element [5.2] is disclosed in Zhang (EX1007).

156. Zhang further discloses that the high-accuracy processing controller creates a higher-resolution 3D model of the teeth using point cloud information obtained after the surfaces are imaged. EX1007, ¶[0056].

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

157. In my opinion, Zhang discloses all the requirements of Element [5.2]—the processor generates a 3D representation of the teeth based on a point cloud alignment after the labial and lingual surfaces are imaged.

F. Claim 6: The system of claim 1, wherein the processor is further configured to generate an occlusal backbone by matching selected frames of the contiguous scan of the occlusal surface that have an overlap based on an analysis of data.

158. Claim 6 is disclosed in Zhang (EX1007).

159. This dependent claim further requires that the processor generate an occlusal backbone by matching certain overlapping frames from the contiguous scan of the occlusal surface from an analysis of data.

160. As used in the '798 Patent, the occlusal backbone is simply the information associated with the entire occlusal surface after being stitched together from data from multiple frames of the occlusal surface. *See, e.g.*, EX1001, 4:20–43, 5:36–41.

161. As discussed above in § X(A)(3), Zhang discloses that a processor generates a contiguous scan of the occlusal surface. EX1007, ¶¶[0041]–[0046], [0090], [0098].

162. And as discussed above in § X(A)(9), Zhang discloses how the processor stitches together overlapping frames to create a 3D model of the occlusal surface. *Id.*, ¶¶[0003], [0043]–[0048], [0055]–[0056], [0090].

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

163. In my opinion, Zhang, discloses all the requirements of Claim 6—a processor generates information about the entire occlusal surface (the occlusal backbone) by stitching together (matching) selected frames of the occlusal surface that were obtained from the contiguous scan of the occlusal surface.

G. Claim 10 (Preamble): A computer readable storage medium for generating an intra-oral scan of a dentition, wherein code stored in the computer readable storage medium, when executed by a processor, causes a system to:

164. Claim 10 is disclosed in Zhang (EX1007) and Babayoff (EX1008).

165. Claim 10 is very similar to Claim 1, except that the processor language of Claim 1 has been replaced by a “computer readable storage medium” limitation.

166. The '798 Patent describes “computer readable storage medium” as any of the typical types of devices that can store computer code, such as memory devices (e.g., RAM, ROM, EPROMS, etc.), hard disks, optical disks, and the like. EX1001, 13:11–24. The patent further describes how computer code stored on this medium can be executed by a computer processor to scan the mouth of a patient to generate a reconstructed 3D model of the patient’s teeth. *Id.*, 13:11–53. Because the processor executes the code stored on this “computer readable storage medium,” the change in claim language from a processor to a “computer readable storage medium” does not meaningfully change the claimed system from that claimed in Claims 1–9.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

167. Nonetheless, Zhang discloses a system 100 comprised of a computer 108 that includes a processor and “computer-usable medium 118,” which includes memory chips, hard drive, and the like. EX1007, ¶[0050]. This “computer-usable medium” can store “computer-readable instructions for execution by the computer 108 to perform the processes described [within the patent application].” *Id.* It can also “store data received from the scanner 102, store a three-dimensional model of the object 104, store computer code for rendering and display, as so forth.” *Id.*

168. The processes described in Zhang include generating an intra-oral scan of dentition. *Id.*, ¶[0006] (“A method disclosed herein includes acquiring a data set from a surface of a dental object with a hand-held scanner from each one of a sequence of poses along a camera path ... and reconstructing a three-dimensional model of the dental object using the optimized camera pose data and the plurality of data sets”). Dental objects include dentition. *Id.*, ¶[0038].

169. Babayoff also discloses a system for intra-oral scanning comprised of a processor that executes code in memory. EX1008, 6:32–47, 28:8–24.

170. In my opinion, to the extent that the preamble is limiting, both Zhang and Babayoff disclose a computer readable storage medium that stores computer code for generating an intra-oral scan of dentition.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

1. **[10.1]: generate a contiguous scan of an occlusal surface of at least a part of one arch of the dentition by capturing a plurality of partially overlapping image frames of the occlusal surface and stitching the overlapping image frames together to form a 3D model of the occlusal surface;**

171. Element [10.1] is disclosed in Zhang (EX1008).

172. This element is essentially identical to Element [1.9] described above in § X(A)(9).

173. And as stated above in § X(A)(9), Zhang discloses that the system generates a contiguous scan of an occlusal surface that includes at least part of one arch of the patient's dentition by capturing multiply overlapping image frames of the occlusal surface and stitching them together to form a 3D model.

174. In my opinion, Zhang discloses all the requirements of Element [10.1].

2. **[10.2]: remove image data of soft tissue from the overlapping image frames used to generate the occlusal scan based at least in part on an analysis of 3D data from the contiguous scan to distinguish between image data of the dentition and the image data of the soft tissue, wherein the soft tissue includes at least one selected from a group consisting of a tongue, a cheek, and a lip;**

175. Element [10.2] is disclosed in Babayoff (EX1008).

176. This element is essentially identical to Element [1.4] described above in § X(A)(4).

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

177. And as stated above in § X(A)(4), Babayoff discloses that image data of soft tissue (such as gums, cheeks, and lips) is removed from the overall scan of the hard tissue (e.g., the occlusal surface) that was created from overlapping frames of data by analyzing the differences between the image data for the hard tissue and soft tissue.

178. It is my opinion that Babayoff discloses all the requirements of Element [10.2].

3. [10.3]: update the contiguous scan of the occlusal surface by restitching the overlapping image frames together after removing the image data of the soft tissue to form an updated 3D model of the occlusal surface; and

179. Element [10.3] is disclosed in Babayoff (EX1008).

180. This element is essentially identical to Element [1.11] described above in § X(A)(11).

181. And as stated above in § X(A)(11), Babayoff discloses that the overall scan data of the hard tissue (e.g., the occlusal surface) from overlapping image frames is restitched once the soft tissue image data has been removed to form an updated 3D model of the hard tissue.

182. In my opinion, Babayoff discloses all the requirements of Element [10.3].

4. **[10.4]: associate a scan of at least one additional surface to the contiguous scan of the occlusal surface by analyzing the scan data to identify a portion of the scan of the at least one additional surface that overlaps with a portion of the contiguous scan of the occlusal surface,**

183. Element [10.4] is disclosed in Zhang (EX1007).

184. This element is essentially identical to Elements [1.5] and [1.6] described above in §§ X(A)(5) and (6).

185. And as described above in §§ X(A)(5) and (6), Zhang discloses that a scan of an additional surface is associated with the contiguous scan of the occlusal surface by analyzing the scan data to identify overlaps in the scans.

186. In my opinion, Zhang discloses all the requirements of Element [10.4].

5. **[10.5]: wherein the scan data includes a sequence of image frames including a plurality of image frames of the occlusal surface interspersed with a plurality of image frames of the at least one additional surface and**

187. Element [10.5] is disclosed in Zhang (EX1007).

188. This element is essentially identical to Element [1.7] described above in § X(A)(7).

189. And as described above in § X(A)(7), Zhang discloses that the scan data includes image frames of the occlusal surface interspersed with image frames of the labial and lingual surfaces.

190. In my opinion, Zhang discloses all the requirements of Element [10.5].

6. [10.6]: determining a position of the scan of the at least one additional surface relative to the scan of the occlusal surface based on the identified overlapping portions.

191. Element [10.6] is disclosed in Zhang (EX1007).

192. This element is essentially identical to Element [1.8] described above in § X(A)(8).

193. And as described above in § X(A)(8), Zhang discloses that the position of a scan of the labial or lingual surface is determined relative to the scan of the occlusal surface by identifying overlaps between the scans.

194. In my opinion, Zhang discloses all the requirements of Element [10.6].

H. Claim 11: The computer readable storage medium of claim 10, wherein the code, when executed by the processor, further causes the system to associate a plurality of scans of additional surfaces to the contiguous scan of the occlusal surface, wherein the plurality of scans of the additional surfaces includes a plurality of scans of labial surfaces and a plurality of scans of lingual surfaces.

195. Claim 11 is disclosed in Zhang (EX1007).

196. Claim 11 is substantively identical to Claim 2, except that it recites that the code in the computer readable storage medium, when executed by the processor, as opposed to just the processor alone, performs the function described in Claim 2—associating multiple scans of both the labial and lingual surfaces with the contiguous scan of the occlusal surface, instead of just one scan of those surfaces.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

197. For the reasons already stated above in § X(B), Zhang discloses multiple scans of the labial and lingual surfaces are associated with the contiguous scan of the occlusal surface.

198. In my opinion, Zhang discloses all the requirements of Claim 11.

I. Claim 12: The computer readable storage medium of claim 11, wherein the occlusal surface is imaged prior to the plurality of labial and lingual surfaces, and wherein the code, when executed by the processor, causes the system to display in real-time a three-dimensional representation of the dentition as the plurality of labial and lingual surfaces are imaged.

199. Claim 12 is disclosed in Zhang (EX1007).

200. Claim 12 is substantively identical to Claim 4, except that it recites that the code in the computer readable storage medium, when executed by the processor, as opposed to just the processor alone, performs the function described in Claim 4—imaging the occlusal surface before the labial and lingual surfaces and further displaying a 3D representation of the patient’s dentition is displayed in real time as the labial and lingual surfaces are imaged.

201. For the reasons already stated above in § X(D), Zhang discloses the occlusal surface is imaged before the labial and lingual surfaces and further that the processor displays a 3D representation of the patient’s dentition in real time as the labial and lingual surfaces are imaged.

202. In my opinion, Zhang discloses all the requirements of Claim 12.

- J. Claim 13: The computer readable storage medium of claim 12, wherein the code, when executed by the processor, causes the system to display in real-time the three-dimensional representation of the dentition by performing a coarse matching by matching features as the plurality of labial and lingual surfaces are imaged, and wherein the code, when executed by the processor, further causes the system to generate a three-dimensional reconstruction of the dentition based on a point cloud alignment after the plurality of labial and lingual surfaces are all imaged.**

203. Claim 13 is disclosed in Zhang (EX1007).

204. Claim 13 is substantively identical to Claim 5, except that it recites that the code in the computer readable storage medium, when executed by the processor, as opposed to just the processor alone, performs the functions described in Claim 5—(i) imaging the occlusal surface before the labial and lingual surfaces and further displaying a 3D representation of the patient's dentition is displayed in real time as the labial and lingual surfaces are imaged; (ii) displaying a real-time coarse 3D representation of the teeth by roughly matching features from the multiple labial and lingual surfaces that were imaged; and (iii) generating a 3D representation of the teeth based on a point cloud alignment after the labial and lingual surfaces are imaged.

205. For the reasons already stated above in § X(E), Zhang discloses these functions.

206. In my opinion, Zhang discloses all the requirements of Claim 13.

K. Claim 14: The computer readable storage medium of claim 10,

207. Claim 14 is dependent on Claim 10 and is substantively identical to Claim 3, except that it recites that the code in the computer readable storage medium, when executed by the processor, as opposed to just the processor alone, performs the function described in Claim 3.

208. For the reasons already stated above in § X(C), Zhang discloses such computer readable storage medium used by the processor.

- 1. [14.1]: wherein the plurality of image frames of the occlusal surface from the scan of the at least one additional surface each overlap with the contiguous scan of the occlusal surface**

209. Element [14.1] is disclosed in Zhang (EX1007).

210. For the reasons already stated above in § X(C)(1), it is my opinion that Zhang discloses the requirements of Element [14.1]—image frames from a scan of an additional surface can include image frames of the occlusal surfaces and that these image frames can overlap with images from the contiguous scan of the occlusal surface.

- 2. [14.2]: wherein the plurality of image frames of the at least one additional surface includes image frames of a labial or lingual surface, and**

211. Element [14.2] is disclosed in Zhang (EX1007).

212. For the reasons already stated above in § X(C)(2), it is my opinion that Zhang discloses the requirements of Element [14.2]—the scans of the additional surfaces include multiple images frames of the lingual and buccal/labial surfaces.

- 3. [14.3]: wherein the code, when executed by the processor, causes the system to use the plurality of image frames of the occlusal surface that is included in the scan of the at least one additional surface to determine a position of the image frames of the labial or lingual surface relative to the contiguous scan of the occlusal surface.**

213. Element [14.3] is disclosed in Zhang (EX1007).

214. For the reasons already stated above in § X(C)(3), it is my opinion that Zhang discloses the requirements of Element [14.3]—the system uses multiple image frames of the scans of the occlusal, lingual, and labial/buccal surfaces to determine the position of the images relative to one another and the scan of the occlusal surface.

- L. Claim 15: The computer readable storage medium of claim 10, wherein the code, when executed by the processor, further causes the system to generate an occlusal backbone by matching selected frames of the contiguous scan of the occlusal surface that have an overlap based on an analysis of data.**

215. Claim 15 is disclosed in Zhang (EX1007).

216. Claim 15 is substantively identical to Claim 6, except that it recites that the code in the computer readable storage medium, when executed by the processor, as opposed to just the processor alone, performs the function described in Claim 3.

217. For the reasons already stated above in § X(F), it is my opinion that Zhang discloses the requirements of Element [15]—a processor executes code that generates information about the entire occlusal surface (the occlusal backbone) by stitching together (matching) selected frames of the occlusal surface that were obtained from the contiguous scan of the occlusal surface.

M. Claim 17: The computer readable storage medium of claim 15 wherein the occlusal backbone is a first occlusal backbone, and wherein the code, when executed by the processor, further causes the system to generate a second occlusal backbone that is more accurate than the first occlusal backbone by linking other frames that are different from the selected frames to the first occlusal backbone.

218. Claim 17 is disclosed in Zhang (EX1007).

219. This dependent claim requires that the system generate a second occlusal backbone that is more accurate than the first occlusal backbone by linking together other frames than were used to generate the first occlusal backbone.

220. As discussed above in §§ X(C)(2) and (L), Zhang discloses that a processor executing code from a computer storage medium that generates a first occlusal backbone from selected frames from the contiguous scan of the occlusal surface in order to create a 3D representation of the occlusal surface.

221. Zhang further discloses that this coarse 3D representation, which it terms the “high-speed three-dimension model 340,” is then sent to a high-accuracy

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

processing controller that executes code to create a more accurate 3D model of the surface. EX1007, ¶¶[0055]–[0056], Fig. 3. Zhang specifically states that separate image sets are used to create this higher-accuracy model of the occlusal surface. *Id.*, ¶[0056]. And Zhang states that these images are stitched together (or linked) to create this high-accuracy model. *Id.*

222. In my opinion, Zhang discloses all the limitations of Claim 17—a processor executes code from a storage medium that generates a second occlusal backbone (the high-accuracy model) that is more accurate than the first occlusal backbone (the high-speed three-dimensional model) using different frames that are linked (stitched) together.

N. Claim 18: The computer readable storage medium of claim 17, wherein the code, when executed by the processor, causes the system to remove the image data of the soft tissue from the contiguous scan of the occlusal surface by generating a third occlusal backbone by removing, from the second occlusal backbone, areas representing the soft tissue.

223. Claim 18 is disclosed in Zhang (EX1007) and Babayoff (EX1008).

224. This dependent claim requires that a processor executes code that creates a third occlusal backbone by removing soft tissue areas from the second occlusal backbone of Claim 17.

225. As described above in §§ X(A)(4) and (G)(2), Babayoff discloses how a processor executing code can remove soft tissue image data from image data that

contains both hard and soft tissue information. EX1008, 2:1–18, 5:11–16, 8:30–66, 9:63–10:28, 22:11–61, 23:34–36, 24:25–47, 26:4–7. Thus, applying the technique described in Babayoff to the high-accuracy model (the second occlusal backbone) described in Zhang yields the third occlusal backbone required in this dependent claim.

226. In my opinion, Zhang and Babayoff disclose all the requirements of Claim 18.

O. Claim 19: The computer readable storage medium of claim 18, wherein the code, when executed by the processor, causes the system to remove the image data of the soft tissue based at least in part on the analysis of 3D data from the contiguous scan by removing the image data of the soft tissue based at least in part on the analysis of the 3D data and at least one selected from a group consisting of a difference in color and a difference in rigidity properties.

227. Claim 19 is disclosed in Babayoff (EX1008).

228. Claim 19 requires that the processor executes code that removes the soft tissue image data by analyzing the 3D data and differences in either the color or rigidity properties of the data.

229. As described above in § X(A)(4), Babayoff uses differences in color to identify the soft tissue from the 3D data. EX1008, 5:11–16. These color differences are then used to distinguish soft tissue from hard tissue:

Then, in step 1320, an algorithm is applied to every pair of spatially adjacent data points, for example, wherein the value of the color parameter *c* of each of these points are compared one with the other, or with respect to some color criteria. When it is determined that the difference in color values is greater than a predetermined threshold, it is then assumed that the pair of data points are on opposite sides of a boundary between two tissues of different color, in particular between the edge of the tooth and the gum.

Id., 25:25–33.

230. Babayoff then states that this method can be used to remove the soft tissue from the hard tissue. *Id.*, 26:4–8 (“The method according to this embodiment may be modified to separate the soft tissues from the hard tissues, once the demarcation line between the two tissues is known, as determined above.”).

231. In my opinion, Babayoff discloses at least the color-related requirements of Claim 19.

P. Explanation of Why Claims 1–6, 10–15, and 17–19 Would Have Been Obvious

232. In my opinion, Claims 1–6, 10–15, and 17–19 would have been obvious over Zhang in view of Babayoff.

1. Difference between the claimed invention and the prior art.

233. As discussed above in § X, Zhang discloses all the features of the system of Claims 1–6, 10–15, and 17–19 with the exception of the removal of the soft tissue image data in Elements/Claims [1.4], [1.10], [1.11], [10.2], [10.3], [18], and [20]. Babayoff discloses those missing limitations.

2. A POSITA would have had motivation to combine the disclosures of Zhang and Babayoff.

234. A POSITA would have had a motivation to combine the system of Zhang with the processing of Babayoff to achieve a more accurate 3D representation of the teeth that did not have images of parts of the soft tissue in the patient's mouth.

235. Zhang et al. stated that there was a need in the dental industry for improved techniques to generate high-accuracy three-dimensional dental reconstructions. EX1007, ¶[0004]. They noted that a variety of artifacts from camera scans can result in errors in the reconstruction. *Id.*, ¶[0003]. And they further noted that their 3D reconstructions can include the gums and soft tissue. *Id.*, ¶[0014]. Such soft tissue can be problematic if it blocks or prevents proper reconstruction of the hard surface of the teeth, such as might occur if a portion of the patient's tongue or cheek appeared in the scan.

236. As Babayoff noted in his patent, dental practitioners had a need to prepare the most accurate reconstructions of dentition in order to properly provide

treatment to their patients, such as by providing orthodontics and dental prostheses that fit better. EX1008, 1:26–49, 1:59–67, 2:16–23. Reconstructions that include soft tissue such as a portion of the tongue or cheeks will lead to orthodontics and dental prostheses that do not fit properly. One of the ways of improving the 3D reconstruction was to identify the soft tissue in the reconstruction and then remove it. *Id.*, 24:25–47.

237. Babayoff discloses a high-accuracy scanning technique (*id.*, 8:14–22) that automatically differentiates between different types of tissues (*id.*, 20:65–21:22) and stitches together overlapping areas to generate a 3D reconstruction of the intra-oral cavity (*id.*, 23:48–24:5).

For example, a three-dimensional Surface scanner with color capabilities may be used. Advantageously, such a scanner makes use of confocal imaging for providing an accurate three-dimensional representation of the target surface within the intra-oral cavity. Color values are then added to each data point of this data set by obtaining a two-dimensional color image of the target surface, and then mapping the color values of the two-dimensional image onto the three-dimensional “image”.

* * * *

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

Referring to FIG. 14, in a first embodiment of the present invention, the method of the invention, generally designated 1100, is particularly adapted for automatically differentiating one tissue from another tissue within the oral cavity. . . . The target surface typically comprises both hard tissues, such as the teeth, and soft tissues which include at least one of the gums, tongue, cheeks and lips.

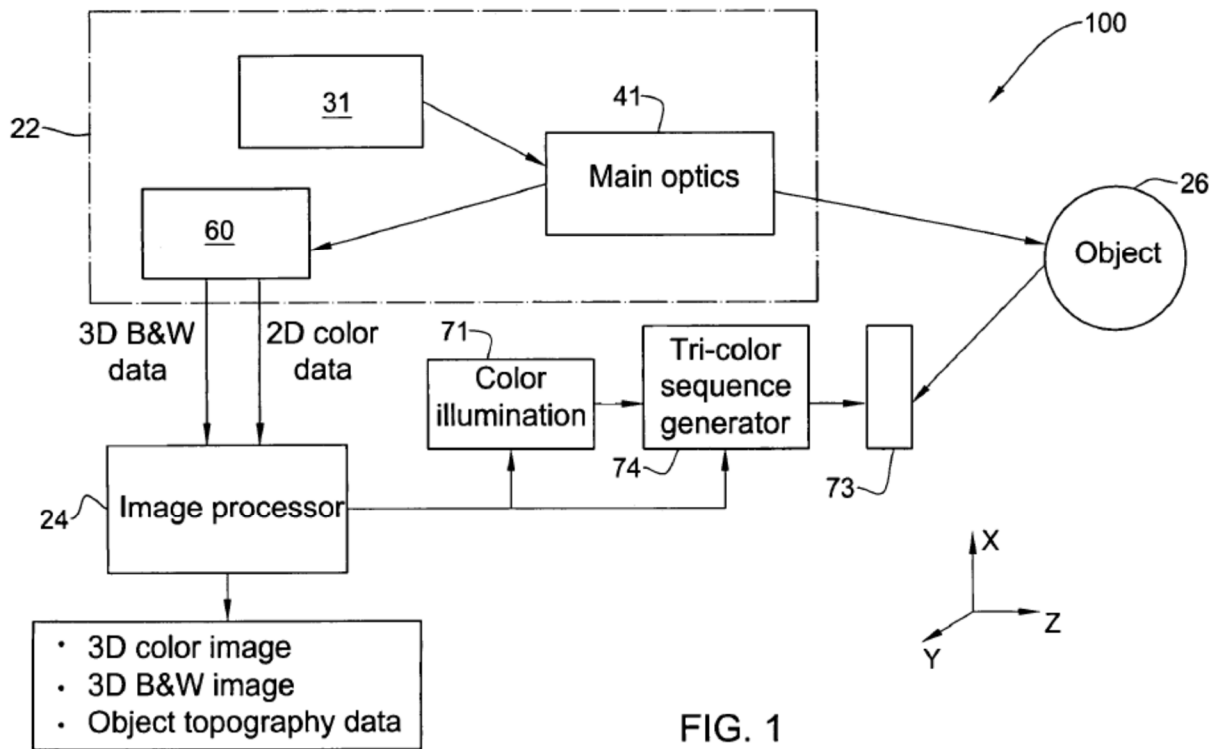
* * * *

[T]he method, generally designated 1200, finds particular use for accurately stitching data sets of over lapping areas scanned within the intra-oral cavity. . . . [B]y identifying the overlap zone within the entities, the spatial relationship between the entities may be established, and the various entities stitched together or combined to form a global numerical entity that comprises the full geometry and color representation of the target zone. The larger the overlap zone, the greater the accuracy with which the different zones may be synchronized together spatially.

(*Id.*, 8:14–22, 20:65–21:9, 23:65–24:5).

238. Graphical descriptions of the process are shown in Figures 1 and 14 of Babayoff, for example:

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798



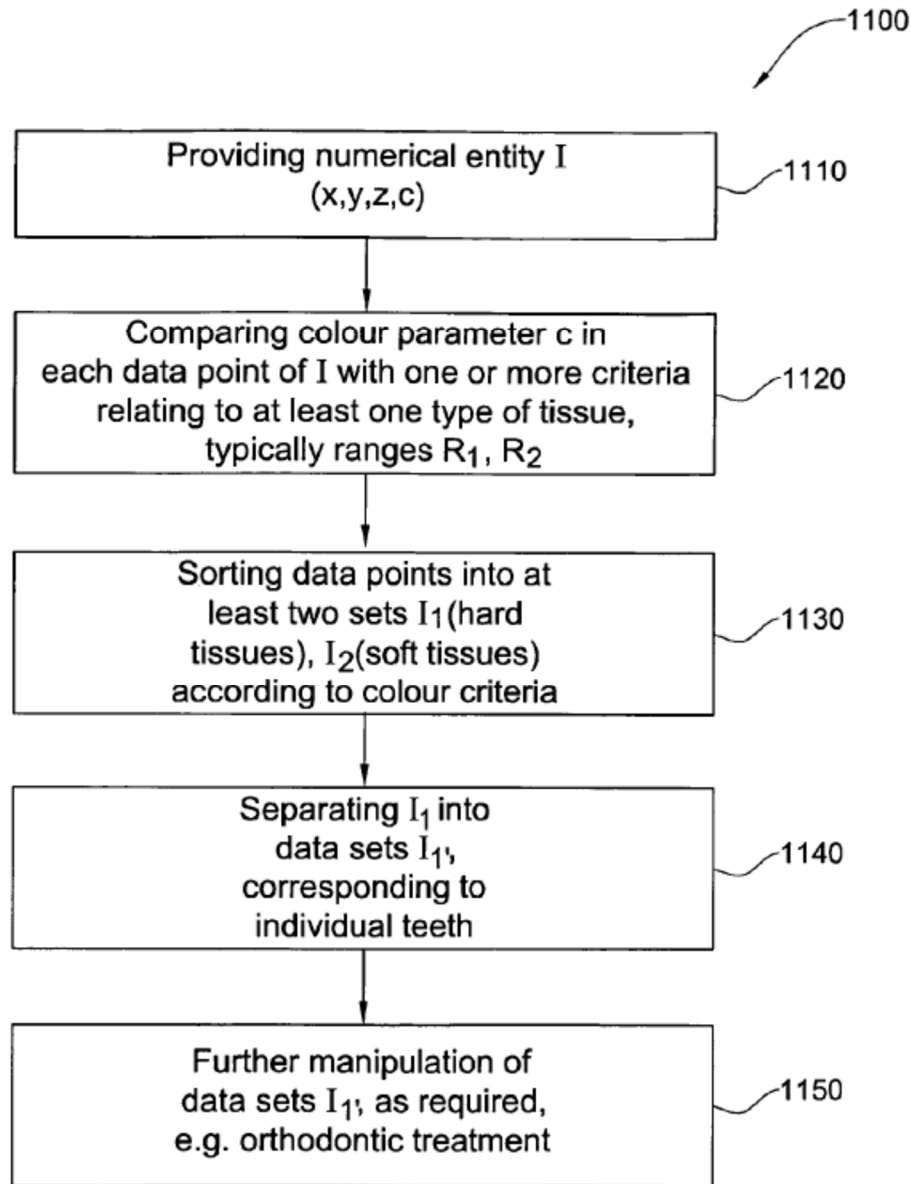


FIG. 14

239. Thus, in my opinion, a POSITA would readily recognize that the system of Zhang could be improved to create more accurate orthodontics if the soft tissue

aspects of the 3D reconstructions were removed. Indeed, this is consistent with the principle behind Zhang, which was to create more accurate 3D reconstructions of teeth. The process described in Babayoff would be one such obvious choice available at that time.

3. A POSITA would have had a reasonable expectation of success based on the disclosures of Zhang and Babayoff and knowledge generally available in the art.

240. In my opinion, one of ordinary skill in the art would have had a reasonable expectation of success of making this combination in view of the fact that both systems utilize hand-held scanning wands with cameras that are inserted into the patient's mouth that acquire multiple images of the features in the mouth to create 3D representations of the patient's teeth. EX1007, ¶¶[0041]–[0043], Fig. 1; EX1008, 10:6–14, 11:36–40, Fig. 20. Both systems send the information from the scanners to computers that process multiple, differing image frames to generate 3D reconstructions, which can be displayed on screens. EX1007, ¶¶[0041], [0043], [0045], [0049], [0054]–[0056], Fig. 1; EX1008, 28:8–40, Fig. 20.

241. The key teachings from Babayoff could be employed in Zhang by only modifying Zhang's software. Hardware changes would not be necessary. Zhang already determined how to reconstruct the images from the scanner into 3D representations of the patient's mouth. Thus, modifying Zhang to achieve the

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

claimed invention of the '798 Patent would only require modification of the existing software to differentiate the soft tissue from the dentition and then remove it, which is readily possible once the teachings of Babayoff are used.

242. The technology and the basic processes described in both references are the same, which creates a reasonable expectation of success that modifying the system of Zhang with the technique described in Babayoff would yield a successful result.

243. Combining the disclosures of Zhang with Babayoff would only require the use of “known methods”—using each in the same way they were used as disclosed. None of the components would need to be used in an unexpected or unintended way. Each would be fulfilling its original purpose and used in an expected way.

244. For all the foregoing reasons, it is my opinion that the combination of Zhang and Babayoff render obvious all the recited features of Claims 1–6, 10–15, and 17–19.

XI. Claims 7 and 16 Would Have Been Obvious Over Zhang in View of Babayoff and Fisker (Ground 2).

245. In my opinion, Claims 7 and 16 are unpatentable over the prior art of Zhang, Babayoff, and Fisker.

246. The following sections explain where each element of Claims 7 and 16 is found in the prior art of Zhang, Babayoff, and Fisker.

A. Claim 7: The system of claim 6, wherein the processor is configured to detect the overlap based on noise characteristics of the data.

247. I have already explained above in §§ X(A) and (F) where the limitations of Claims 1 and 6, from which Claim 7 depends, can be found in Zhang and Babayoff, which are incorporated herein by reference.

248. The additional requirements of Claim 7 are disclosed in Fisker (EX1009).

249. Claim 7 further requires that the processor is configured to detect the overlapping image frames based on noise characteristics of the data.

250. Fisker describes a near threshold distance to determine what objects in an image can be disregarded when generating 3D models of a patient's mouth. This distance is defined based on the noise present in the images, which causes errors when trying to register or align overlapping images. The distance chosen attempts to minimize disregarding appropriate information and maximize excluding inaccurate information. The amount of noise in the image data is used in setting this near threshold distance. EX1009, 9:16–10:4, 53:17–29.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

251. Fisker states that the methods and processes described in the patent are “implemented in software and carried out on a data processing system or other processing means caused by the execution of computer-executable instructions.” *Id.*, 57:20–22; *see also* 38:21–26.

252. Fisker, therefore, discloses that a processor uses noise characteristics of the image data to detect the overlap in the images.

253. In my opinion, Fisker discloses all the requirements of Claim 7.

B. Claim 16: The computer readable storage medium of claim 15, wherein the code, when executed by the processor, further causes the system to detect the overlap based on noise characteristics of the data.

254. I have already explained above in §§ X(G) and (L) where the limitations of Claims 10 and 15, from which Claim 16 depends, can be found in Zhang and Babayoff, which are incorporated herein by reference.

255. Claim 16 is identical to Claim 7, so for the same reasons discussed above in § XI(A), Zhang, Babayoff, and Fisker disclose all the limitations of Claim 16.

C. Explanation of Why Claims 7 and 16 Would Have Been Obvious

256. In my opinion, Claims 7 and 16 would have been obvious over Zhang in view of Babayoff and Fisker.

1. Difference between the claimed invention and the prior art.

257. As discussed above in § X, Zhang and Babayoff disclose all the features of the system of Claims 7 and 16 with the exception of the use of noise characteristics in the reconstruction process. Fisker discloses those missing limitations.

2. A POSITA would have had motivation to combine the disclosures of Zhang, Babayoff, and Fisker.

258. As discussed above in § X(P)(2), it is my opinion that a POSITA would have had a motivation to combine the system of Zhang with the processing of Babayoff to achieve a more accurate 3D representation of the teeth that did not have images of parts of the soft tissue in the patient's mouth. The addition of the noise-based processing of Fisker would have been another obvious improvement to the processing of the data to improve its accuracy and efficiency.

259. Zhang et al. stated that there was a need in the dental industry for improved techniques to generate high-accuracy three-dimensional dental reconstructions. EX1007, ¶[0004]. Zhang further recognized that “errors can result in a variety of reconstruction artifacts in a resulting three-dimensional model.” *Id.*, ¶[0003]. Zhang saw the need for “improved global path optimization techniques suitable for use with data-intensive path optimizations typical of high-accuracy, three-dimensional dental reconstruction.” *Id.*, ¶[0004].

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

260. Babayoff disclosed how to obtain high-accuracy intra-oral scans using similar hardware that differentiated between different surfaces in the mouth (such as hard vs. soft tissue) and then stitched overlapping images together to create a 3D model of the intra-oral cavity. EX1008, 8:14–22, 20:65–21:22, 23:48–24:5.

261. Fisker recognized that the accuracy of the stitching process used to combine overlapping dental images into 3D models could be improved if objects closer than a near threshold distance were excluded from the calculations. EX1009, 9:16–10:4, 53:17–29. Images of objects closer than this near threshold distance suffered from noise issues. *Id.*

262. Thus, in my opinion, a POSITA would readily recognize that the systems of Zhang and Babayoff could be improved to create a better optimized technique for dental reconstructions if the noise characterization of Fisker was also employed to improve registration/alignment between representations. *Id.*, 9:16–10:4. The process described in Fisker would be one such obvious choice available at that time.

3. A POSITA would have had a reasonable expectation of success based on the disclosures of Zhang, Babayoff, and Fisker and knowledge generally available in the art.

263. In my opinion, one of ordinary skill in the art would have had a reasonable expectation of success of making this combination because all the

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

systems utilized hand-held scanning wands with cameras that are inserted into the patient's mouth that acquire multiple images of the features in the mouth to create 3D representations of the patient's teeth. EX1007, ¶¶[0041]–[0043], Fig. 1; EX1008, 10:6–14, 11:36–40, Fig. 20; EX1009, 1:24–26, 7:19–22, 8:7–10, 25:18–20, 42:16–23, 43:1–5. All three systems send the information from the scanners to computers that process the multiple, differing image frames to generate the 3D reconstructions. EX1007, ¶¶[0041], [0043], [0045], [0049], [0054]–[0056], Fig. 1; EX1008, 28:8–40, Fig. 20; EX1009, 57:19–26.

264. The key teachings from Fisker could be employed in Zhang/Babayoff by only modifying the software. Hardware changes would not be necessary. Zhang/Babayoff already determined how to reconstruct the images from the scanner into 3D representations of the patient's mouth. Thus, modifying them to achieve the claimed invention of Claims 7 and 16 would only require modification of the existing software to use noise characteristics from the image data to generate more accurate scans, which is readily possible once the teachings of Fisker are used.

265. The technology and the basic processes described in both references are the extremely similar, which creates a reasonable expectation of success that modifying the system of Zhang/Babayoff with the technique described in Fisker would yield a successful result.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

266. Combining the disclosures of Zhang with Babayoff and Fisker would only require the use of “known methods”—using each in the same way they were used as disclosed. None of the components would need to be used in an unexpected or unintended way. Each would be fulfilling its original purpose and used in an expected way.

267. For all the foregoing reasons, it is my opinion that the combination of Zhang, Babayoff, and Fisker render obvious all the recited features of Claims 7 and 16.

XII. Claim 8 Would Have Been Obvious Over Zhang in View of Babayoff and Dillon (Ground 3).

268. In my opinion, Claim 8 is unpatentable over the prior art of Zhang, Babayoff, and Dillon.

269. The following sections explain where each element of Claim 8 is found in the prior art of Zhang, Babayoff, and Dillon.

A. Claim 8: The system of claim 1, further comprising:

270. I have already explained above in § X(A) where the limitations of Claim 1, from which Claim 8 depends, can be found in Zhang and Babayoff, which are incorporated herein by reference.

1. **[8.1]: a projector that projects interferometric fringes on an occlusal surface of at least a part of one arch of the dentition primarily along an anterior-posterior direction; and**

271. Element [8.1] is disclosed in Dillon (EX1010).

272. Element [8.1] requires that the system have a projector that projects interferometric fringes on an occlusal surface of at least part of a dental arch primarily along the anterior-posterior direction. Dillon discloses such limitations.

273. In ¶[0017], Dillon states that the “embodiments described below ... use structured illumination patterns generated by interferometric fringe projection.” EX1010; *see also* ¶¶[0018], [0020].

274. Dillon uses a “fringe projector 18” to illuminate the surface of objects (such as teeth) with a “pattern of interference fringes 26.” *Id.*, ¶[0019]. One such projector is wand 66, which can be used to obtain 3D data for a portion of a dental arch. *Id.*, ¶¶[0022]–[0023]. To do so, the clinician illuminates a portion of the occlusal surface of the arch with the structured light pattern (the interferometric fringes). *Id.*, ¶¶[0025]–[0026].

275. Dillon discusses how the clinician starts at the patient’s left back molar and moves towards the front of the dental arch, i.e., along the anterior-posterior direction. *Id.*, ¶[0025]. Dillon further notes how the interferometric fringes can be

parallel to the direction of motion of the wand, i.e., also along the anterior-posterior direction. *Id.*

276. In my opinion, Dillon discloses all the limitations of Element [7.1]—(1) a projector that projects interferometric fringes (2) on an occlusal surface of at least part of a dental arch (3) primarily along the anterior-posterior direction.

**2. [8.2]: an imaging sensor that is used to view the
interferometric fringes,**

277. Element [8.2] is disclosed in Dillon (EX1010).

278. Element [8.2] requires an imaging sensor that views the interferometric fringes. Dillon also meets this limitation.

279. Dillon describes an imager that images these fringes onto an array of photodetectors, such as a CCD array (an imaging sensor), that is passed along to a processor.

An image of the fringe pattern at the object 22 is formed by an imaging system or lens 30 onto an imager that includes an array of photodetectors 34. For example, the detector array 34 can be a two-dimensional charge coupled device (CCD) imaging array. An output signal generated by the detector array 34 is provided to a processor 38.

EX1010, ¶[0019], Fig. 1.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

280. In my opinion, Dillon discloses all the requirements of Element [8.2]—
an imaging sensor that views interferometric fringes.

**3. [8.3]: wherein the processor is further configured to
generate the contiguous scan of the occlusal surface based
on the interferometric fringes sensed by the imaging sensor.**

281. Element [8.3] is disclosed in Dillon (EX1010).

282. Element [8.3] requires that a processor generates a contiguous scan of
the occlusal surface based on the interferometric fringes sensed by the imaging
sensor. Dillon also meets this limitation.

283. As discussed above in § XII(A)(2), the imaging sensor sends data based
on the interferometric fringes to the processor. EX1010, ¶[0019]. Dillon also notes
how this system can scan the occlusal surface of the dental arch in a contiguous
motion to generate a complete 3D data set of the dental arch using the interferometric
fringe pattern. *Id.*, ¶¶[0023]–[0025].

284. The processor uses the information from this contiguous scan to create
the representation of the object surface (such as the occlusal surface). *Id.*, ¶¶[0019]–
[0021].

285. In my opinion, Dillion discloses all the requirements of Element [8.3]—
(1) a processor (2) that generates a contiguous scan of the occlusal surface (3) based
on interferometric fringes sensed by the image sensor.

B. Explanation of Why Claim 8 Would Have Been Obvious

286. In my opinion, Claim 8 would have been obvious over Zhang in view of Babayoff and Dillon.

1. Difference between the claimed invention and the prior art.

287. As discussed above in § X, Zhang and Babayoff disclose all the features of the system of Claim 8 with the exception of the use of interferometric fringes in the reconstruction process. Dillon discloses those missing limitations.

2. A POSITA would have had motivation to combine the disclosures of Zhang, Babayoff, and Dillon.

288. As discussed above in § X(P)(2), it is my opinion that a POSITA would have had a motivation to combine the system of Zhang with the processing of Babayoff to achieve a more accurate 3D representation of the teeth that did not have images of parts of the soft tissue in the patient's mouth. The addition of the interferometric fringes of Dillon would have been another obvious improvement to the processing of the data to improve its accuracy and efficiency.

289. Zhang et al. stated that there was a need in the dental industry for improved techniques to generate high-accuracy three-dimensional dental reconstructions. EX1007, ¶[0004]. Zhang further recognized that “errors can result in a variety of reconstruction artifacts in a resulting three-dimensional model.” *Id.*, ¶[0003]. Zhang saw the need for “improved global path optimization techniques

suitable for use with data-intensive path optimizations typical of high-accuracy, three-dimensional dental reconstruction.” *Id.*, ¶[0004]. Dillon recognized that the accuracy of the 3D models could be improved if the teeth were illuminated with interferometric fringes (using Accordion Fringe Interferometry (AFI)) “that can be used for high precision 3D measurements based on interferometric fringe projection.” EX1010, ¶¶[0016]–[0018].

290. In my opinion, a POSITA would readily recognize that the system of Zhang could be improved to yield a better optimized technique for dental reconstructions if the interferometric fringe illumination of Dillon was also employed. The process described in Dillon would be one such obvious choice available at that time.

3. A POSITA would have had a reasonable expectation of success based on the disclosures of Zhang, Babayoff, and Dillon and knowledge generally available in the art.

291. In my opinion, one of ordinary skill in the art would have had a reasonable expectation of success of making this combination because all the systems utilized hand-held scanning wands with cameras that are inserted into the patient’s mouth that acquire multiple images of the features in the mouth to create 3D representations of the patient’s teeth. EX1007, ¶¶[0041]–[0043], Fig. 1; EX1008, 10:6–14, 11:36–40, Fig. 20; EX1010, ¶¶[0019]–[0022]. All three systems used

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

external illumination to assist in the scanning process. EX1007, ¶[0044]; EX1008, 8:30–35; EX1010, ¶¶[0019], [0022]. All three systems send the information from the scanners to computers that process the multiple, differing image frames to generate 3D reconstructions. EX1007, ¶¶[0041], [0043], [0045], [0049], [0054]–[0056], Fig. 1; EX1008, 28:8–40, Fig. 20; EX1010, ¶¶[0020]–[0021].

292. The key teachings from Dillon could be employed in Zhang/Babayoff by only modifying the type of illumination and the software. Other hardware changes would not be necessary. Zhang/Babayoff already determined how to reconstruct the images from the scanner into 3D representations of the patient’s mouth using an external illumination source. Thus, modifying them to achieve the claimed invention of Claim 8 would only require modification of the particular illumination source and the existing software to interpret the interference fringes in order to generate more accurate scans, which is readily possible once the teachings of Dillon are used.

293. The technology and the basic processes described in the references are the same, which creates a reasonable expectation of success that modifying the system of Zhang/Babayoff with the technique described in Dillon would yield a successful result.

294. Combining the disclosures of Zhang with Babayoff and Dillon would only require the use of “known methods”—using each in the same way they were used as disclosed. None of the components would need to be used in an unexpected or unintended way. Each would be fulfilling its original purpose and used in an expected way.

295. For all the foregoing reasons, it is my opinion that the combination of Zhang, Babayoff, and Dillon render obvious all the recited features of Claim 8.

XIII. Claims 9 and 20 Would Have Been Obvious Over Zhang in View of Babayoff and Johnson (Ground 4).

296. In my opinion, Claims 9 and 20 are unpatentable over Zhang in view of Babayoff and Johnson.

297. The following sections explain where each element of Claims 9 and 20 is found in the prior art of Zhang, Babayoff, and Johnson.

- A. Claim 9: The system of claim 1, wherein the processor is configured to remove the image data of soft tissue from the contiguous scan of the occlusal surface based at least in part on the analysis of 3D data from the contiguous scan by distinguishing between the image data of the dentition and the image data of the soft tissue based at least in part on a comparison of surface normals of 3D structures in the contiguous scan.**

298. I have already explained above in §X(A) where the limitations of Claim 1, from which Claim 9 depends, can be found in Zhang and Babayoff, which are incorporated herein by reference.

299. Claim 9 further requires that the processor removes soft tissue image data from the occlusal scan based in part on an analysis of the differences between the surface normals of the 3D structures of the dentition and soft tissue.

300. Johnson describes how to use surface normals to distinguish between dissimilar structures in a 3D image using a technique spin-images. *See, e.g.,* EX1011, Abstract, pp.1–9.

This thesis describes a data level representation of surfaces used for surface matching. In our representation, surface shape is described by a dense collection of oriented points, 3-D points with surface normal. Using a single point basis constructed from an oriented point, the position of other points on the surface can be described by two parameters. The accumulation of these parameters for many points on the surface results in an image at each oriented point. These images, localized descriptions of the global shape of the surface, are invariant to rigid transformations. Through correlation of images, point correspondences between two surfaces can be established. When two surfaces have many point correspondences, they match. Taken together, the oriented points and associated images make up our surface representation. Because the image generation process can be visualized as a sheet spinning

about the normal of a point, the images in our representation are called spin-images.

301. Johnson explains that, “[u]sing adjacency and position of sensed 3-D points surface normal can be computed” and shows these surface normals in Figure 1-1. *Id.*, p. 4.

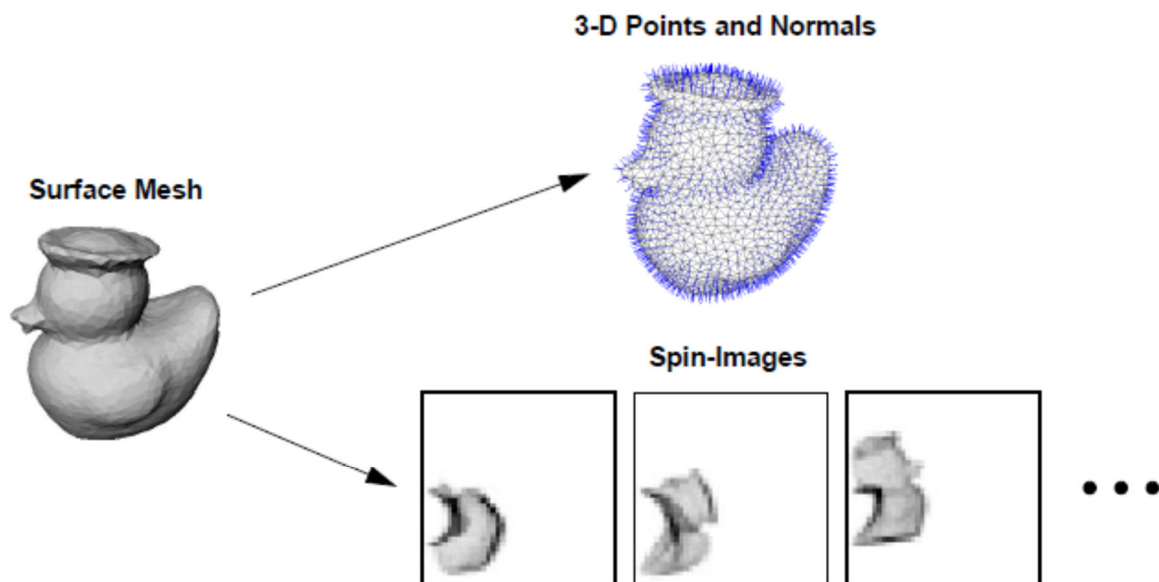


Figure 1-1: Components of our surface representation. A surface described by a polygonal surface mesh can be represented for matching as a set of 3-D points, surface normals and spin-images.

Id.

302. Johnson further explains how these surface normals can be calculated:

We define an oriented point O at a surface mesh vertex using the 3-D position of the vertex p and surface normal at the vertex n . The surface normal at a vertex is computed by fitting a plane to the points connected to the vertex by the surface mesh. Specifically, surface normal at a vertex

is the eigenvector with the smallest eigenvalue of the inertia matrix of vertex and the other vertices directly connected to it by the edges of the surface mesh [22]. The above eigenvector computation does not determine the inside/outside direction of the surface normal; for spin-image generation, oriented points should be oriented to the outside of the object surface. If the surface mesh was created from a sensor with a single viewing direction, then the normal direction can be chosen as the one pointing toward the sensor. Otherwise, surface normals of a mesh must be oriented to the outside of the object using the following heuristic.

These surface normals are shown graphically in Figure 2-1:

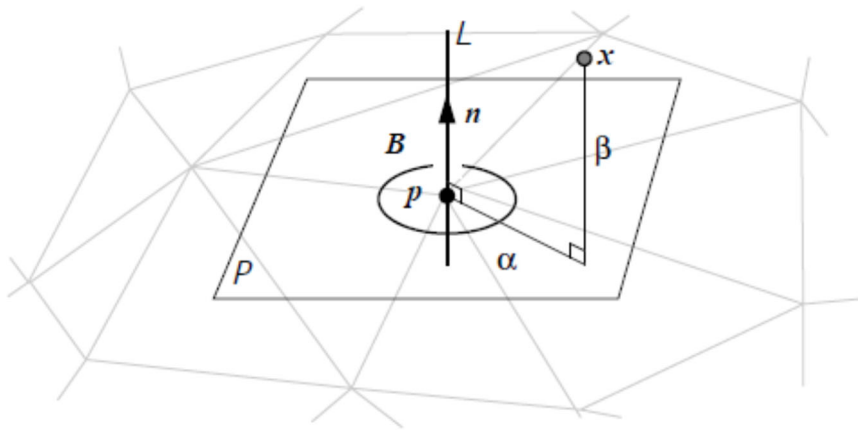


Figure 2-1: An oriented point basis created at a vertex in a surface mesh. The position of the oriented point is the 3-D position of the vertex, and the direction of the oriented point is the surface normal at the vertex. Two coordinates can be calculated given an oriented point: α the radial distance to the surface normal line L and β the axial distance above the tangent plane P .

Id., pp. 15–16.

303. Johnson describes how surface normals are used to determine whether surfaces match or overlap with one another:

Two surfaces match, or overlap, when many points on one surface are close to many points on the other surface. If the surfaces are oriented, then matched surfaces should also have consistently oriented surface normals; closest points between the two surfaces should be similar in 3-D position and surface normal.

Johnson shows a graphical example of this matching technique in Figure 3-7:

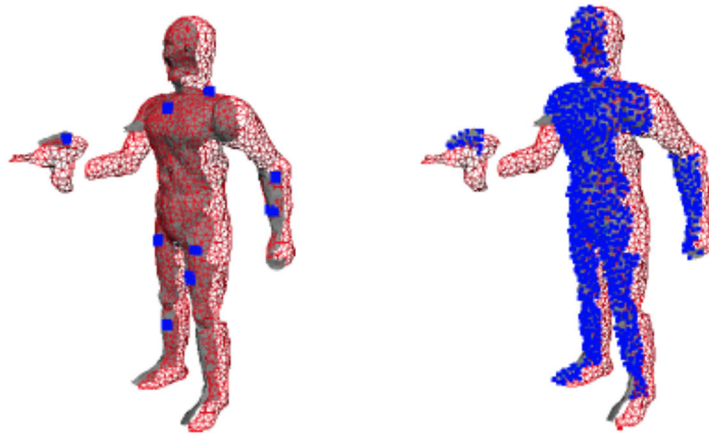


Figure 3-7: Transformation verification of two views of a toy robot. On the left is shown the match between the views before verification, one surface is shown as wireframe, the other is shown shaded; initial correspondences from spin-image matching are shown as squares. On the right is shown the same view of the match after verification with spread correspondences shown as smaller squares. Notice that correspondences are not established outside the region of overlap between the two views.

Id., p. 45.

304. Others have used this same technique in intraoral applications. EX1012.

305. The software process described in Johnson could readily be used with the 3D data generated by Zhang/Babayoff to distinguish and then remove soft tissue from dentition in the contiguous scan of the occlusal surface, thereby satisfying the requirements of this claim.

B. Claim 20: The computer readable storage medium of claim 10, wherein the code stored in the computer readable storage medium, when executed by the processor, cause the system to remove the image data of soft tissue from the contiguous scan of the occlusal surface based at least in part on the analysis of 3D data from the contiguous scan by distinguishing between the image data of the dentition and the image data of the soft tissue based at least in part on a comparison of surface normals of 3D structures in the contiguous scan.

306. Claim 20 is identical to Claim 9, so for the same reasons discussed above in § XIII(A), Zhang, Babayoff, and Johnson disclose all the limitations of Claim 20.

C. Explanation of Why Claims 9 and 20 Would Have Been Obvious

307. In my opinion, Claims 9 and 20 would have been obvious over Zhang in view of Babayoff and Johnson.

1. Difference between the claimed invention and the prior art.

308. As discussed in § X, Zhang and Babayoff disclose all the features of the system of Claims 9 and 20 with the exception of the use of surface normals in the reconstruction process. Johnson discloses those missing limitations.

2. A POSITA would have had motivation to combine the disclosures of Zhang, Babayoff, and Johnson.

309. As discussed in § X(P)(2), a POSITA would have had a motivation to combine the system of Zhang with the processing of Babayoff to achieve a more accurate 3D representation of the teeth that did not have images of parts of the soft tissue in the patient's mouth. The addition of the surface normal technique of Johnson would have been another obvious improvement to the processing of the data to improve its accuracy.

310. Johnson disclosed a technique for distinguishing between structures in a 3D model based on surface normals that could be employed to distinguish between soft tissue and dentition. EX1011.

311. Thus, a POSITA would readily recognize that the system of Zhang could be improved to yield a better optimized technique for dental reconstructions if the surface normals technique of Johnson was also employed. The process described in Johnson would be one such obvious choice available at that time. Indeed, other intraoral scanning devices employed this technique. EX1012, 2:9–3:23.

3. A POSITA would have had a reasonable expectation of success based on the disclosures of Zhang, Babayoff, and Johnson and knowledge generally available in the art.

312. One of ordinary skill in the art would have had a reasonable expectation of success of making this combination because all the systems send the information

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

from the scanners to the connected computers that process the multiple, differing image frames to generate 3D reconstructions. EX1007, ¶¶[0041], [0043], [0045], [0049], [0054]–[0056], Fig. 1; EX1008, 28:8–40, Fig. 20; EX1011, pp. 1–9.

313. The key teachings from Johnson could be employed in Zhang/Babayoff by only modifying the software. Zhang/Babayoff already determined how to reconstruct the images from the scanner into 3D representations of the patient’s mouth. Modifying them to achieve the claimed invention of Claims 9 and 20 would only require modification of the existing software to compute surface normals and then subsequently utilize those calculated surface normals to distinguish between the respective surfaces to generate more accurate scans, which is readily possible once the teachings of Johnson are used.

314. The technology and the basic processes described in the references are the same, which creates a reasonable expectation of success that modifying the system of Zhang/Babayoff with the technique described in Johnson would yield a successful result.

315. Combining the disclosures of Zhang with Babayoff and Johnson would only require the use of “known methods”—using each in the same way they were used as disclosed. None of the components would need to be used in an unexpected

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

or unintended way. Each would be fulfilling its original purpose and used in an expected way.

316. In my opinion, for all the foregoing reasons, the combination of Zhang, Babayoff, and Johnson render obvious all the recited features of Claims 9 and 20.

XIV. SECONDARY CONSIDERATIONS

317. As discussed herein, it is my opinion that all elements of Claims 1–20 were known in the art, and any differences would have been obvious to a POSITA based on the disclosures of the applied references and the knowledge in the art.

318. I am not aware of any secondary considerations evidence bearing any nexus to the purported claimed invention. Any purported evidence of secondary considerations that Patent Owner may present in this proceeding would be insufficient to overcome the strong evidence of obviousness of Claims 1–20.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

XV. CONCLUSION

319. For the reasons set forth above, it is my opinion that all elements of Claims 1–20 of the '798 Patent are disclosed or suggested by the prior art. In my opinion, Claims 1–20 of the '798 Patent would have been anticipated or obvious over the prior art.

320. In signing this Declaration, I understand that the Declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I acknowledge that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

321. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Date: February 12, 2024



Eli Saber

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

APPENDIX 1

I have previously testified and/or been consulted as an expert in the
following matters:

RealD, LLC v. Microsoft Corp., No. 2:22-cv-00942-TL

Feb. 2023 – Present

- Legal Firm: Michelman & Robinson
- Retained as an expert on behalf of RealD, LLC
- Provided expert opinions and a declaration in support of IPR2023-01046. Patent Owner Preliminary Response filed on 10/13/2023.
- Provide expert opinions and additional reports in support of Federal case.
- Provide algorithm support for software review

Autonomous Devices LLC v. Tesla, Inc.

October 2022 - Present

US District Court, District of Delaware

- Legal Firm: McKool-Smith
- Retained as an expert by the Barr Group on behalf of Autonomous Devices.
- Provided declarations in support of legal proceedings.
- Working on multiple IPRs (5X): IPR2023-01054, IPR2023-01055, IPR2023-01169, IPR2023-01172, IPR2023-01173

Medit USA, Crown Jade Co. Ltd. (Petitioner) v. 3Shape A/S (Patent Owner)

Oct. 2023 – Present

US Patent and Trademark Office, Patent Trial and Appeal Board

- Legal Firm: Buchanan, Ingersoll and Rooney PC
- Retained as an expert on behalf of 3Shape A/S to provide expert opinions on proceedings involving U.S. Patent Nos. 9,629,551; 10,064,553; 10,695,151; 11,076,146; 11,368,667; 7,912,257; 9,191,648; 9,245,374 and 9,262,864.
- Provide expert opinions in support of Patent Owner Response proceedings

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

Facetec, Inc. v. iProov Ltd., Case No. 2:21-cv-02252-ART-BNW

October 2022 - Present

US District Court, District of Nevada

- Legal Firm: OneLLP
- Retained as an expert by Teklicon on behalf of FaceTec, Inc.
- Provided expert opinions as needed in support of legal proceedings

TVISION INSIGHTS v. The NIELSEN Company (US), LLC

August 2023 - Present

US Patent and Trademark Office, Patent Trial and Appeal Board

- Legal Firm: Erise Intellectual Property Law
- Retained as an expert on behalf of the Nielsen Company (US), LLC
- Provided expert opinions and a declaration in support of patent owner in IPR2023-01014.
- Documents were filed on 10/11/2023.
- PTAB decision to institute/not institute expected in January 2024.

Meta Platforms, Inc. f/k/a Facebook, Inc. v. Angel Technologies Group LLC

May 2023 - Present

US District Court, District of Nevada

- Legal Firm: McKool-Smith
- Retained as an expert by Alliance Technical Staffing on behalf of Angel Technologies Group LLC.
- Provide expert opinions and declarations in support of four IPR proceedings (IPR2023-00057, IPR2023-00058, IPR2023-00059, IPR2023-00060).
- Provided a Deposition on October 20th, 2023 for IPR2023-00057, IPR2023-00058, IPR2023-00059
- Provided a Deposition on October 23rd, 2023 for IPR2023-00060.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

In Re Lyft Rideshare Litigation

Dec. 2021 – Present

Superior Court of the State of California, Case No. CJC-20-005061

- Legal Firm: Williams & Connolly, LLP
- Retained as an expert by WIT Legal, LLC on behalf of Lyft (Defendant)
- Provide reports and consulting services on the challenges of the use of Dashcam solutions in Vehicles
- Provided a Deposition on March 24th, 2023.

The first portion of the Case that requires my expertise has been settled.

Alarm.com Incorporated v. Vivint, Inn, No. 2:23-CV-00004-JRG-RSP

March 2023 – Dec. 2023

- Legal Firm: Cravath, Swaine and Moore, LLP
- Retained as an expert on behalf of Alarm.com, Inc.
- Case has been settled

HL Holdings, Inc. v. LNHL, LLC, et al.

July 2023 – Dec. 2023

- Legal Firm: Nelson, Mullins, Riley and Scarborough LLP
- Retained as an expert by IMS Consulting and Expert Services on behalf of LNHL, LLC and Seek Now Inc. f/k/a Ladder Now LLC.
- Provided expert opinions and a report in support of legal proceedings.
- Provided a Deposition on November 29th, 2023
- Case has been settled.

Angel Group Co. Ltd. V. Sensen Networks Group Pty Ltd

July 2023 – Oct. 2023

- Legal Firm: Norton Rose Fulbright
- Retained as an expert on behalf of Angel Group Co. Ltd.
- Provide expert opinions in support of a potential IPR proceeding.
- Case has been settled.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

United Services Automobile Association v. Truist Bank

March 2023 – Oct. 2023

- Case No. 2-22-CV-00291
- Legal Firm: Cravath, Swaine and Moore, LLP
- Retained as an expert on behalf of Truist Bank.
- Performed review of six patents.
- Case was settled.

Dental Imaging Technologies Corp. (Petitioner) v. 3Shape A/S (Patent Owner)

Feb. 2023 – July 2023

US Patent and Trademark Office, Patent Trial and Appeal Board

- Legal Firm: Buchanan, Ingersoll and Rooney PC
- Retained as an expert on behalf of 3Shape A/S.
- Provided consulting services in support of POPR for IPR2023-00387 (US 11,076,146).
- Provided consulting services in support of POPR for IPR2023-00400 (US 10,695,151).
- Provided consulting services in support of POPR for IPR2023-00411 (US 11,368,667).
- PTAB decision to NOT Institute on all three IPRs.

Nike v. Valmarc

January 2023 – Present

- Legal Firm: Hilgers Graben
- Retained as an expert on behalf of Valmarc Corporation
- Provided expert opinions in support of Patent Owner Preliminary Response on petitions IPR2022-01403 & IPR2022-01404
- PTAB granted institution but client opted not to pursue defending the patents.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

Sensormatic Electronics, LLC v. Genetec, Inc. et al.

Oct. 2021 – Feb. 2023

US District Court, District of Delaware, Case 1:20-cv-00760-MN

- Legal Firm: Fish & Richardson, P.C.
- Retained as an expert by IMS Expert Services on behalf of Genetec, Inc. et al. (Defendant)
- Representing Genetec (USA) Inc. and Genetec Inc. (C. A. No. 20-760)
- Provided Opening, Rebuttal and Reply reports regarding invalidity & Non-infringement with regards to US 7,307,652.
- Sat in on a deposition of Plaintiff expert (April 29th, 2022) per counsel request.
- Provided a deposition on May 3rd, 2022
- Case is completed.

Roku, Inc. v. Flexiworld Technologies, Inc.

June 2022 – October 2022

US Patent and Trademark Office, Patent Trial and Appeal Board, Case No. IPR2022-01112

US Patent and Trademark Office, Patent Trial and Appeal Board, Case No. IPR2022-001269

- Legal Firm: Perkins-Coie, LLP
- Retained as an expert by WIT Legal, LLC on behalf of Roku (Petitioner).
- Provided a declaration in June 2022 in support of the IPR petition for US 10,140,073.
- Provided a declaration in July 2022 in support of the IPR petition for US 7,944,577.
- Case was settled in October 2022.

CareView Communications, Inc. v. Interactive Digital Solutions, Inc.

Jan. 2022 – April 2022

- Legal Firm: Mintz, Levin, Cohn, Ferris, Glovsky & Popeo, P. C.
- Retained as an expert by IMS Expert Services on behalf of Interactive Digital Solutions, LLC (Defendant) to provide declarations in support of 3 IPR proceedings
- Case was settled in April 2022.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

Sovereign Peak Ventures, LLC v. Hisense Co., LTD

Nov. 2021 – Dec. 2021

US District Court, Eastern District of Texas, Case No. 21-cv-00209

- Legal Firm: Perkins-Coie, LLP
- Retained as an expert by WIT Legal, LLC on behalf of Hisense Co. (Defendant).
- Working to provide a declaration in support of the IPR petition for US 8,019,169.
- Case was settled in Early 2022.

Perfect Corporation v. Lennon Image Technologies, LLC

Sept. 2021 – June 2022

US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2021-00124

- Legal Firm: Perkins-Coie, LLP
- Retained as an expert by WIT Legal, LLC on behalf of Perfect Corporation (Petitioner).
- Provided a declaration in support of the IPR petition for US 6,624,843.
- Petitioner filed a motion to dismiss its petition on April 5th, 2022.

Apple Inc. v. Corephotonics, LTD

Jan. 2021 – May 2021

- Legal Firm: Russ, August & Kabat,
- Retained as an expert by WIT Legal, LLC on behalf of Corephotonics in two IPR cases.
- Provided two declarations in support of IPR Petitions IPR2020-00487 & IPR2020-00860.
- Provided a deposition on 04/14/2021.

Davis Polk

Aug. 2020 – Nov. 2021

- Legal Firm: Davis Polk
- Retained as an expert by WIT Legal, LLC
- Provided expert and consulting services for video and point cloud type imagery.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

Cravath, Swaine & Moore, LLP

Feb. 2020 – Mar. 2020 and Jan. 2021

- Legal Firm: Cravath, Swaine & Moore, LLP
- Retained as an expert by WIT Legal, LLC
- Evaluated computer vision technology for various clients.
- No reports, depositions or expert testimonies were provided.

Wells Fargo & Co. v. Lighthouse Consulting Group

Feb. 2020 – Sept. 2020

US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2020-00758 and IPR2020-00759

- Legal Firm: Winston & Strawn LLP
- Retained as an expert by DOAR on behalf of Petitioner Wells Fargo.
- Submitted two declarations in support of IPR Petitions IPR2020-00758 & IPR2020-00759 for US 8,590,940 and US RE44,274.

3Shape A/S v. Align Technology, Inc.

Jan. 2020 – April 2020

US District Court, District of Delaware, Case No. 18-cv-00886 (consolidated with 18-cv-00697)

- Legal Firm: Buchanan, Ingersoll and Rooney, PC
- Retained as an expert by DOAR on behalf of plaintiff for US Patents-in-Suit Nos. 9,962,244 and 9,629,551 with regards to invalidity.
- Case was transferred to Troutman Pepper LLP very shortly after my engagement.

3Shape A/S et al v. Align Technology, Inc.

Oct. 2019 – Oct. 2020

US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2020-00222 and IPR2020-00223

- Legal Firm: Buchanan, Ingersoll and Rooney, PC
- Retained as an expert by DOAR on behalf of Petitioner 3Shape A/S with respect to US 7,156,661
- Provided two declarations in support of IPR petitions (IPR2020-00223 and IPR2020-0222) for US 7,156,661. Both petitions were filed in December 2019.
- Provided a deposition on July 30th, 2020 in support of IPR2020-00223 that was instituted by PTAB and supporting materials for follow on responses.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

Uniloc 2017 LLC v. Netflix, Inc. (Petitioner) (18-cv-2055)

July 2019 – July 2020

US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2020-00044

- Legal Firm: Perkins-Coie, LLP
- Retained as an expert by DOAR on behalf of Petitioner Netflix, Inc.
- Provided an expert declaration in support of IPR2020-00044 for US 6,584,229.
- Case was settled in July 2020.

Align Technology, Inc. v. 3Shape A/S et al

Feb. 2019 – Feb. 2022

US District Court, District of Delaware, Case No. 17-cv-01646 (LPS) (CJB)

- Legal Firm: Troutman Pepper LLP
- Retained as an expert by WIT Legal, LLC on behalf of Defendant 3Shape for US Patent-in-Suit No. 9,510,757 ('757 Patent).
- Served as expert for invalidity and non-Infringement for US 9,510,757
- Provided expert reports regarding Invalidity and non-infringement of '757
- Provided a deposition on 10 January 2020
- Case was settled in February 2022.

Certain Dental and Orthodontic Scanners and Software

Feb. 2019 – Oct. 2019

US International Trade Commission, Investigation No. 337-TA-1144 (3Shape v. Align)

- Legal Firm: Pepper Hamilton, PC
- Retained as an expert by DOAR on behalf of respondent 3Shape A/S with respect to US Patent-in-Suit No. 9,299,192 ('192 Patent).
- Served as expert on invalidity, non-infringement and domestic industry.
- Provided expert opinions and rebuttal reports in support of the above proceedings.
- Provided a deposition (8/13/2019).
- Provided trial testimony on October 30th, 2019 (Trial was held Oct. 24-30, 2019) with regards to Invalidity, Non-infringement and Domestic Industry.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

3Shape A/S et al v. Align Technology, Inc.

Oct. 2018 – Sept. 2019

US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2019-00132 and IPR2019-00134 and IPR2019-00148

- Legal Firm: Buchanan, Ingersoll and Rooney, PC
- Retained as an expert by DOAR on behalf of respondent 3Shape A/S with respect to US 7,112,065, US 9,451,873 and US 9,299,192
- Represented 3Shape (Petitioner) in three IPR Petitions v. Align (Patent Owner).
- Provided three declarations in support of the IPR petitions for US 7,112,065, US 9,299,192 and US 9,451,873. All three petitions were filed in November 2018 and all three were instituted.
- Provided three depositions with regards to US 7,112,065 (8/16/2019), US 9,451,873 (09/18/2019) and US 9,299,192 (09/30/2019).

Blackberry Corp. et al v. Maxell, Ltd

Sept. 2018 – Oct. 2018

US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2019-00087 and IPR2019-00095 and IPR2019-00097

- Legal Firm: Oblon, McClelland, Maier and Neustadt, LLP
- Retained as an expert on behalf of petitioner Blackberry Corp.
- Provided three declarations in support of the IPR petitions for US 9,100, 604 (Joinder), US 6,765, 616 and US 7,995,897.
- Case settled in May 2019.

Exocad GmbH et al v. 3Shape A/S

March 2018 – Sept. 2019

US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2018-00788

- Legal Firm: Buchanan, Ingersoll and Rooney, PC
- Retained as an expert by DOAR on behalf of 3Shape A/S in defending an IPR filings of EXOCAD (Petitioner) v. 3Shape (Patent Owner). Case No. IPR 2018-00788
- Provided a declaration in support of the Patent Owner response for US 9,336,336.
- Provided a deposition on April 1st, 2019.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

Certain Intraoral Scanners and Related Hardware and Software

February 2018 – Sept. 2018

US International Trade Commission, Investigation No. 337-TA-1090 & No. 337-TA-1091 (Align v. 3Shape)

- Legal Firm: Pepper Hamilton, LLP
- Retained as an expert by DOAR on behalf of respondent 3Shape A/S.
- Provided expert opinions regarding claim construction, noninfringement, and the domestic industry analysis.
- Attended a *Markman* hearing and provided a tutorial for the technology in suit.
- Provided a Deposition on July 16, 2018.
- Provided trial testimony as an expert on Sept. 20th, 2018 with regards to Non-infringement and Domestic Industry.

Nikon Corporation et al v. ASML Netherlands BV et al

July 2017 – Nov. 2017

US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2018-00227

- Legal Firm: Morrison & Foerster
- Retained as an expert on behalf of petitioner Nikon Corporation.
- Provided an expert declaration in support of IPR petition for US 7,209,167.

Raster Printing Innovations, LLC v. Hewlett-Packard Company et al

April 2016 – May 2016

US District Court, Northern District of Illinois, Case No. 15-cv-03967

- Legal Firm: Morgan, Lewis & Bockius, LLP
- Retained as an expert by IMS Expert Services on behalf of defendant Hewlett Packard.
- Contributed to the development of initial invalidity contentions charts.
- Case settled very quickly after my engagement in June 2016.

Qomo Hitevision LLC v. Pathway Innovations and Technologies, Inc.

Nov. 2015 – Jan. 2016

US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2016-00661

- Legal Firm: Mei & Mark, LLP
- Retained as an expert on behalf of petitioner Qomo Hitevision.
- Provided an expert declaration in support of petition for inter partes review.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 11,234,798

Sony Corp of America. v. Image Processing Technologies, LLC

Aug. 2014 – Nov. 2014

US Patent and Trademark Office, Patent Trial and Appeal Board

- Legal Firm: Lerner, David, Littenberg, Krumholz & Mentlik LLP
- Retained as an expert on behalf of Sony.
- Provided an expert declaration in support of petition to institute inter partes review of US Patent No. 6,959,293.

Image Processing Technologies, LLC v. Canon Inc. et al

June 2011 – Dec. 2012

Case: US District Court, Eastern District of New York, Case No. 10-cv-03867

- Legal Firm: Fitzpatrick, Cella, Harper & Scinto
- Retained as an expert on behalf of defendant Canon Inc.
- Traveled to Japan twice to meet with Canon Technical & Engineering Teams
- Provided reports related to Invalidity, Non-Infringement, Rebuttals, and summary judgement.
- Provided a Deposition in April 2012.